CALFED
BAY-DELTA
PROGRAM

Environmental Water Program Steering Committee
Briefing Paper No. 7

A Compendium of Existing Flow Recommendations for Central Valley Streams

Prepared for:

CALFED Bay-Delta Program
Environmental Water Program Steering Committee
1416 Ninth Street, Suite 1155
Sacramento, CA 95814

Prepared by:

Jones & Stokes
2600 V Street
Sacramento, CA 95818-1914
Contact: Craig Stevens
916/737-3000

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Executive Summary

This paper summarizes existing flow related recommendations, goals, objectives, and proposed actions for 32 Central Valley rivers and streams as outlined in the Ecosystem Restoration Program Plan (ERPP), including the Strategic Plan, the Final Restoration Plan for the Anadromous Fish Restoration Program (AFRP), and the U.S. Fish and Wildlife Service Draft Guidelines for Allocation of Water Acquired Pursuant to Section 3406(b)(3) of the Central Valley Project Improvement Act (AFRP Guidelines).

Because each document's recommendations are not organized and classified in the same way, there is no consistent way to present the data from document to document. Accordingly, the discussions as they pertain to each watershed follow the following outline:

Ecosystem Restoration Program Plan, Volume II: Ecological Management Zone Visions (Restoration Targets and Programmatic Actions)
  - Ecological Processes
  - Eliminating or Reducing Stressors
  - Habitats

Strategic Plan for Ecosystem Restoration, Appendix D. Draft Stage 1 Actions

Final Restoration Plan for the Anadromous Fish Restoration Program

U.S. Fish and Wildlife Service Draft Guidelines for Allocation of Water Acquired Pursuant to Section 3406(b)(3) of the Central Valley Project Improvement Act
  - Species and Life History–Stage Priorities
  - Recommendations
  - Draft Guidelines for the Allocation of Acquired Water (in tabular format)

Chapter 1. Relevant Ecosystem Restoration Program Plan and Anadromous Fish Restoration Program Goals and Objectives

INTRODUCTION

This paper is part of a larger compendium of information being compiled for those helping to formulate the Environmental Water Program (EWP) so that they can develop an understanding of the existing flow recommendations, goals, objectives, and proposed actions in the Ecosystem Restoration Program Plan (ERPP), including the Strategic Plan, the Final Restoration Plan for the Anadromous Fish Restoration Program (AFRP), and the U.S. Fish and Wildlife Service Draft Guidelines for Allocation of Water Acquired Pursuant to Section 3406(b)(3) of the Central Valley Project Improvement Act (AFRP Guidelines). The table below provides a summary of each river detailed in this paper and indicates which of the documents referenced contains specific river flow objectives, recommendations, or goals for those rivers.

Summary of Each River Contained in This Compendium

River	ERPP Vol. II	ERPP Strategic Plan	Final Restoration Plan for the AFRP	AFRP Guidelines
Sacramento-San Joaquin Delta	X	X	X	
Mokelumne River	X		X	X
Cosumnes River	X		X	
Calaveras River	X		X	X
Suisun Marsh/North San Francisco Bay	X			
Sacramento River	X		X	
North Sacramento Valley	X			
Clear Creek	X	X	X	
Cow Creek	X		X	
Bear Creek	X		X	
Battle Creek	X	X	X	
Cottonwood Creek	X			
Colusa Basin			X	
Stony Creek			X	
Butte Basin	X			
Butte Creek	X	X	X	
Paynes Creek	X		X	
Antelope Creek	X		X	
Mill Creek	X	X	X	
Deer Creek	X	X	X	
Feather River	X		X	X

River	ERPP Vol. II	ERPP Strategic Plan	Final Restoration Plan for the AFRP	AFRP Guidelines
Yuba River	X		X	X
Bear River	X		X	X
American River	X		X	
Yolo Basin	X			
Cache Creek	X			
Putah Creek	X			
West San Joaquin Basin	X			
San Joaquin River	X	X	X	
Stanislaus River	X		X	X
Tuolumne River		X	X	X
Merced River			X	X

The purpose of the EWP and the organization of the ERPP are discussed in Briefing Paper 6, "CALFED Commitments and Baseline Conditions Relevant to the Environmental Water Program." This briefing paper focuses on water flow goals and objectives and highlights decisions listed in the above-mentioned documents.

Each of the documents referenced in this paper describes broad goals and visions that relate to water flow. These goals and visions are included below.

ERPP Strategic Plan for Ecosystem Restoration and Ecosystem Restoration Program Plan Volume One: Ecological Attributes of the San Francisco Bay–Delta Watershed

The ERPP Strategic Plan states six overall goal topics (Strategic Plan, pages 23–43):

1. At Risk Species
2. Ecosystem Processes and Biotic Communities
3. Harvested Species
4. Habitats
5. Non-Native Invasive Species
6. Sediment and Water Quality

Associated with each of the six goals for the ERPP is a series of objectives intended to assess progress toward achieving the associated goal. The objectives are primarily actions, but some are also stated in terms of studies.

Goal 2, Ecosystem Processes and Biotic Communities, pertains most directly to water flow needs. It reads: "Rehabilitate natural processes in the Bay-Delta estuary and its watershed to fully support, with minimal ongoing human intervention, natural aquatic and associated terrestrial biotic communities and habitats, in ways that favor native members of those communities (Strategic Plan, Page 23–24)."

Goal 2 has eight objectives. These objectives are listed below and on pages 31–33 of the Strategic Plan and on page 48 of *Vol. 1: Ecosystem Restoration Program Plan, Ecological Attributes of the San Francisco Bay–Delta Watershed*.

OBJECTIVE 1: Establish and maintain hydrologic and hydrodynamic regimes for the Bay and Delta that support the recovery and restoration of native species and biotic communities, support the restoration and maintenance of functional natural habitats, and maintain harvested species.

OBJECTIVE 2: Increase estuarine productivity and rehabilitate estuarine food web processes to support the recovery and restoration of native estuarine species and biotic communities.

OBJECTIVE 3: Rehabilitate natural processes to create and maintain complex channel morphology, in-channel islands, and shallow water habitat in the Delta and Suisun Marsh.

OBJECTIVE 4: Create and/or maintain flow and temperature regimes in rivers that support the recovery and restoration of native aquatic species.

OBJECTIVE 5: Establish hydrologic regimes in streams, including sufficient flow timing, magnitude, duration, and high flow frequency, to maintain channel and sediment conditions supporting the recovery and restoration of native aquatic and riparian species and biotic communities.

OBJECTIVE 6: Re-establish floodplain inundation and channel-floodplain connectivity of sufficient frequency, timing, duration, and magnitude to support the restoration and maintenance of functional natural floodplain, riparian, and riverine habitats.

OBJECTIVE 7: Restore coarse sediment supplies to sediment-starved rivers downstream of reservoirs to support the restoration and maintenance of functional natural riverine habitats.

OBJECTIVE 8: Increase the extent of freely meandering reaches and other pre-1850 river channel forms to support the restoration and maintenance of functional natural riverine, riparian, and floodplain habitats.

Volume I of the ERPP includes a summary of visions for ecosystem elements addressed in the plan (ERPP Vol. I, pages 34–52).

Ecosystem Processes

Hydrology and Hydraulics

Central Valley Streamflows. The vision for Central Valley streamflows is to protect and enhance the ecological functions that are achieved through the physical and biological processes that operate within the stream channel and associated riparian and floodplain areas in order to assist in the recovery of at-risk species, harvested species, biotic communities, and the overall health of the Bay-Delta.

Bay-Delta Hydraulics. The vision for hydraulic processes in the Sacramento–San Joaquin Delta is to restore channel hydraulics to conditions more like those that occurred during the mid-1960s to provide migratory cues for aquatic species; transport flows for eggs, larvae, and juvenile fish; and transport of sediments and nutrients.

Channel Forming Processes

Stream Meander. The vision for stream meander is to conserve and reestablish areas of active stream meander, where feasible, by implementing stream conservation programs, setting levees back, and reestablishing natural sediment supply to restore riverine and floodplain habitats for fish, wildlife, and plant communities.

Natural Floodplains and Flood Processes. The vision for natural floodplains and flood processes is to conserve existing intact floodplains and modify or remove barriers to overbank flooding to reestablish aquatic wetland, and riparian floodplain habitats.

Coarse Sediment Supply. The vision for coarse sediment supply is to provide a sustained supply of alluvia sediments that are transported by rivers and streams and distributed to riverine bed deposits, floodplains, channel bars, riffles, shallow shoals, and mudflats, throughout the Sacramento–San Joaquin Valley, Delta, and Bay regions to contribute to habitat structure, function, and foodweb production throughout the ecosystem.

Cycling and Transport of Nutrients, Detritus, and Organisms: Bay-Delta Aquatic Foodweb

The vision for the Bay-Delta aquatic foodweb is to restore primary and secondary production to levels comparable to those during the 1960s and early 1970s by enhancing productivity and reducing loss of productivity as a result of water export from the system, and in seeking to reduce or eliminate the adverse effects of introduced aquatic species.

Water Quality: Central Valley Stream Temperatures

The vision for Central Valley stream temperatures is to restore natural season patterns of water temperature in streams, rivers, and the Delta to benefit aquatic species by protecting and improving ecological processes that regulate water temperature and reducing stressors that change water temperature.

Final Restoration Plan for the Anadromous Fish Restoration Program

The goal of the AFRP, as stated in Section 3406(b)(1) of the Central Valley Project Improvement Act (CVPIA), is to "develop within three years of enactment and implement a program which makes all reasonable efforts to ensure that, by the year 2002, natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967–1991." Section 3406(b)(1) also states that "this goal shall not apply to the San Joaquin River between Friant Dam and the Mendota Pool (AFRP, Page 4)."

Six general objectives need to be met to achieve the program goal:

Improve habitat for all life stages of anadromous fish through provision of flows of suitable quality, quantity, and timing, and improved physical habitat;

Improve survival rates by reducing or eliminating entrainment of juveniles at diversions;

Improve the opportunity for adult fish to reach their spawning habitats in a timely manner;

Collect fish population, health, and habitat data to facilitate evaluation of restoration actions;

Integrate habitat restoration efforts with harvest and hatchery management; and

Involve partners in the implementation and evaluation of restoration actions (AFRP, Page 4).

U.S. Fish and Wildlife Service Draft Guidelines for Allocation of Water Acquired Pursuant to Section 3406(b)(3) of the Central Valley Project Improvement Act

This document contains flow recommendations and draft guidelines for eight non-Central Valley Project (CVP) rivers. The document was developed "to handout following a public workshop held on October 23, 1996 in Sacramento. The objective of the workshop was to

present and discuss [the AFRP] approach to developing flow scenarios that might be achieved through water acquisition for streams on which Central Valley Project structures do not control flows (non-CVP streams). Three programs authorized by the CVPIA are involved in developing these flow scenarios. These are the AFRP, the Water Acquisition Program, and the [CVPIA] Programmatic Environmental Impact Statement." (AFRP Guidelines, Preface).

FLOW RECOMMENDATIONS, ACTIONS, TARGETS, EVALUATIONS, AND OBJECTIVES

The following chapters contain flow-related recommendations, actions, targets, evaluations and objectives cited from ERPP Volume II, Appendix D of the ERPP Strategic Plan, the AFRP, and the AFRP Guidelines. Each chapter covers a river or river basin. Within each chapter are flow recommendations from each of the four documents mentioned above, if applicable. Since each document has organized and classified its recommendations in a slightly different way, there is no consistent way to present the data from document to document. Accordingly, the discussions as they pertain to each watershed will follow the following outline:

Ecosystem Restoration Program Plan, Volume II: Ecological Management Zone Visions (Restoration Targets and Programmatic Actions)
  - Ecological Processes
  - Eliminating or Reducing Stressors
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The organization of each document is summarized below.

Ecosystem Restoration Program Plan, Volume II. Ecological Management Zone Visions (Restoration Targets and Programmatic Actions)

The target classification system used in the ERPP Volume II sections is as follows:

Class	Description
♦	Target for which additional research, demonstration, and evaluation is needed to determine feasibility or ecosystem response.
♦♦	Target that will be implemented in stages with the appropriate monitoring to judge benefit and success.
♦♦♦	Target that has sufficient certainty of success to justify full implementation in accordance with adaptive management, program priority setting, and phased implementation (ERPP Vol. II, Page 97).

Strategic Plan for Ecosystem Restoration, Appendix D. Draft Stage 1 Actions

Appendix D contains a draft list of ERP actions for Stage 1 implementation. The draft Stage 1 actions are a subset of programmatic actions described in Volume II of the ERPP that are feasible to implement in the first 7 years and that address key stressors for high-priority watersheds and areas of the Bay and Delta. The proposed actions in Appendix D are provisional. Continuing work efforts will help to refine the draft Stage 1 actions by articulating assumptions about ecosystem structure and function, and by applying a set of project selection/prioritization criteria (Strategic Plan, Page 44).

Final Restoration Plan for the Anadromous Fish Restoration Program

The actions and evaluations that follow came from several sources, including the AFRP Working Paper, public and private organizations, and individual contributors. They were subjected to a process to determine reasonable actions described in the Restoration Plan. Some actions from the Working Paper were determined to be unreasonable or in need of further evaluation, and are not included here. Some of those actions were replaced, while others were changed to evaluations rather than actions. With some actions, the language and intent were changed, perhaps reducing their potential biological benefit, to make them reasonable but still maintaining their contribution to increasing natural production of anadromous fish. Others were combined (AFRP, Page 34).

Actions and evaluations with an arrow (➔) preceding their description in the first column are underway or have high potential for implementation in the near future. These are actions that the U.S. Fish and Wildlife Service (USFWS) and U.S. Bureau of Reclamation (USBR), partners, or individual sponsors have indicated they are implementing or could begin to implement in the near future (AFRP, Page 34).

U.S. Fish and Wildlife Service Draft Guidelines for Allocation of Water Acquired Pursuant to Section 3406(b)(3) of the Central Valley Project Improvement Act

Flow recommendations are listed in two forms: a brief text description of the recommendations of the participating agencies; and tabular lists of prioritized guidelines, organized by specific water-year levels, for blocks of water allocated to specific targeted life-history stages of anadromous fish. Supporting information is included next to each water block value that explains the source of the recommendation.

Chapter 2. Sacramento–San Joaquin Delta

ERPP VOL. II

The Sacramento–San Joaquin Delta Ecological Management Zone is defined by the legal boundary of the Sacramento–San Joaquin River Delta (Delta). It is divided into four regional Ecological Management Units: North Delta, East Delta, South Delta, and Central and West Delta Ecological Management Units. The Delta extends between the upper extent of the tidewater (near the city of Sacramento on the Sacramento River and Mossdale on the San Joaquin River) and Chipps Island to the west, and encompasses the lower portions of the Sacramento and San Joaquin river-floodplain systems as well as those of some lesser tributaries (e.g., Mokelumne River, Calaveras River).

Ecological Processes, Central Valley Streamflows

General Target: The general target is to more closely approach the natural (unimpaired) seasonal Delta outflow patterns that:

- transport sediments,
- stimulate the estuary foodweb,
- provide for up and downstream fish passage,
- contribute to riparian vegetation succession,
- transport larval fish to the entrapment zone,
- maintain the entrapment zone and natural salinity gradient, and
- provide adequate attraction and migrating flows for salmon, steelhead, American shad, white sturgeon, green sturgeon, lamprey striped bass, splittail, delta smelt, and longfin smelt.

Target 1: Provide a March outflow that occurs from the natural late-winter and early-spring peak inflow from the Sacramento River. This outflow should be at least 20,000 cubic feet per second (cfs) for 10 days in dry years, at least 30,000 cfs for 10 days in below-normal water

years, and 40,000 cfs for 10 days in above-normal water years. Wet-year outflow is generally adequate under the present level of development (♦ ♦). (ERPP Vol. II, Page 98)

Programmatic Action 1A: Prescribed outflows in March should be met by the cumulative flows of prescribed flows for the Sacramento, Feather, Yuba, and American Rivers. Assurances must be obtained (e.g., to limit Delta diversions) that these prescribed flows will be allowed to contribute to Delta outflow. A portion of the inflow would be from base (minimum) flows from the east Delta tributaries and the San Joaquin River and its tributaries. (ERPP Vol. II, Page 98)

Target 2: Provide a late-April to early May outflow that emulates the spring inflow from the San Joaquin River. The outflow should be at least 20,000 cfs for 10 days in dry years, 30,000 cfs in below normal years, and 40,000 cfs in above normal years. These flows would be achieved through base flows from the Sacramento River and flow events from the Mokelumne, Calaveras, Stanislaus, Tuolumne, and Merced Rivers (♦). (ERPP Vol. II, Page 98)

Programmatic Action 2A: Prescribed outflows in late April and early May should be met by the cumulative prescribed flows from the Stanislaus, Tuolumne, and Merced rivers (see East San Joaquin Basin Ecological Management Zone), and Mokelumne and Calaveras Rivers (see Eastside Delta Tributaries Ecological Management Zone). It will be necessary to obtain assurances that these prescribed flows are allowed to contribute to Delta outflow. The flow event would be made up of:

- the Cosumnes River,
- Mokelumne, Calaveras, and San Joaquin,
- tributary pulsed flows prescribed under the May 1995 Water Quality Control Plan (WQCP),
- and supplemental flows. (ERPP Vol. II, Page 98)

Target 3: Provide a fall or early winter outflow that approximates the first "winter" rain through the Delta (♦). (ERPP Vol. II, Page 98)

Programmatic Action 3A: Allow the first "significant" fall/winter natural flow into the Delta (most likely either from rainfall or from unimpaired flows from tributaries and lower watersheds below storage reservoirs or from flows recommended by the California Department of Fish and Game (CDFG) and the AFRP to pass through the Delta to the San Francisco Bay by limiting water diversions for up to 10 days. (No supplementary release of stored water from reservoirs would be required above that required to meet flows prescribed by CDFG and AFRP.) (ERPP Vol. II, Page 98)

Target 4: Provide a minimum flow of 13,000 cfs on the Sacramento River below Sacramento in May of all but critical years (U.S. Fish and Wildlife Service 1995) (♦).(ERPP Vol. II, Page 98)

Programmatic Action 4A: Supplement flows in May of all but critical years as needed from Shasta, Oroville, and Folsom Reservoirs to maintain an inflow of 13,000 cfs to the Delta. (ERPP Vol. II, Page 98)

Ecological Processes, Delta Hydrodynamics

Target 1: Reestablish more natural internal Delta water flows in channels (♦♦♦). (ERPP Vol. II, Page 101)

Programmatic Action 1A: Reduce velocities in selected Delta channels by increasing cross-sectional areas of channel by means of setback levees or by constricting flows into and out of the channels. (ERPP Vol. II, Page 101)

Programmatic Action 1B: Increase tidal flow and cross-Delta transfer of water to south Delta pumping plants to selected channels to lessen flow through other channels. (ERPP Vol. II, Page 101)

Programmatic Action lC: Manage the operation of existing physical barriers so that resulting hydraulics upstream and downstream of the barrier are more like levels in the mid-1960s. (ERPP Vol. II, Page 101)

Programmatic Action 1D: Close the DCC when opportunities allow, as specified in the 1995 WQCP and recommended by the USFWS (1995), in the period from November through January when appropriate conditions trigger closure (i.e., internal Delta exports are occurring). (ERPP Vol. II, Page 101)

Target 3: Maintain net downstream flows in the mainstem San Joaquin River from Vernalis to immediately west of Stockton from September through November to help sustain dissolved oxygen levels and water temperatures adequate for upstream migrating adult fall-run chinook salmon (♦♦).(ERPP Vol. II, Page 101)

Programmatic Action 3A: Operate a barrier at the head of Old River from August through November. (ERPP Vol. II, Page 101)

Target 4: Restore 50 to 100 miles of tidal channels (303 to 606 acres) in the southern Yolo Bypass within the north Delta, while maintaining or improving the flood carrying capacity of the Yolo Bypass (♦). (*Note: This target is in addition to targets and programmatic actions presented in the Delta Slough habitat section.*) (ERPP Vol. II, Page 101–102)

Programmatic Action 4A: Construct a network of channels within the Yolo Bypass to connect the Putah and Cache Creek sinks, and potentially the Colusa drain, to the Delta. These channels should effectively drain all flooded lands in the bypass after floodflows stop entering the bypass from the Fremont and Sacramento weirs. The channels would maintain a base flow through the spring to allow juvenile anadromous and resident fish to move from rearing and migratory areas. (ERPP Vol. II, Page 102)

Programmatic Action 4B: Reduce flow constrictions in the Yolo Bypass such as those in the openings in the railway causeway that parallels Interstate 80. (ERPP Vol. II, Page 102)

ERPP STRATEGIC PLAN, APPENDIX D

The Delta is the tidal confluence of the Sacramento and San Joaquin Rivers. The three major habitat corridors envisioned include the following:

North Delta Habitat Corridor
East Delta Habitat Corridor
San Joaquin River Habitat Corridor

North Delta Habitat Corridor

Major features of the North Delta are the Yolo Bypass, the Sacramento Deep Water Ship Channel, the Sacramento River downstream of Sacramento to Rio Vista, and sloughs connecting the Sacramento River to the Cache Slough complex at the base of the Yolo Bypass.

Action 1. Increase the duration of Yolo Bypass flooding in winter and spring by modifying the Fremont Weir (and possibly the Sacramento Weir) to allow lower-stage flows of the Sacramento River to pass through the Yolo Bypass in order to increase the beneficial impacts of bypass flooding for native fishes. (Strategic Plan, Page D-4)

Action 3. Evaluate the feasibility and benefits of widening the Tule Canal/Toe Drain channel, restoring riparian vegetation and improving year-round flows. Potential actions include:

Excavate a wider channel to convey winter and spring flows from the Fremont Weir;

Allocate water to sustain higher summer and fall flows (non-flood) through the Tule Canal/Toe Drain;

Better connect the channel by enlarging existing culverts, etc. to allow fish passage at low flows;

Construct new channels connecting the Tule Canal/Toe Drain with Putah Creek, Cache Creek and the Fremont Weir fish ladder; and

Restore riparian habitat along the Tule Canal/Toe Drain, including on the Sacramento Ship Channel levee. (Strategic Plan, Pages D-4, D-5)

Action 4. Evaluate potential flood conveyance impacts from actions 1 to 3. Conduct a feasibility analysis to increase flood flow capacity in the Yolo Bypass to compensate for lost flood capacity from Bypass restoration. (Strategic Plan, Page D-5)

Enlarging the openings of the railroad causeway may be an alternative to increase capacity.

East Delta Habitat Corridor

No flow-related actions listed.

San Joaquin River Habitat Corridor

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

This river is of highest priority to the AFRP.

The operational targets listed below are the AFRP recommendations to the CALFED Operations Group (Ops Group). These targets allow variability in the timing and nature of operations to meet requirements in the 1995 WQCP. Also listed are supplemental actions requiring water that may involve changes in operations beyond the authority of the Ops Group that further contribute to meeting the AFRP goal. (AFRP, Page 97)

These supplemental actions (some in slightly modified form) are being used to develop an implementation plan in the form of the CVP operational forecast for water year 1997 and to develop a long-term CVP Water Management Plan that integrates these supplemental actions with upstream flow actions and Delta operational targets. (AFRP, Page 97)

In addition, these supplemental actions requiring water formed the basis for the nine priorities that were provided to the AFRP programmatic Environmental Impact Statement (PEIS) team for their use in developing alternatives for the PEIS; this was provided to interested parties

in a letter dated October 25, 1996 announcing an AFRP workshop on proposed fish flow and habitat objectives for selected Central Valley rivers and the Delta. (AFRP, Page 97)

The following operational targets, supplemental actions, and evaluations are intended to be consistent with and supportive of the CALFED Bay-Delta process, the Bay-Delta Agreement's criterion to maintain conditions sufficient to achieve a doubling of production of chinook salmon, and with the narrative water quality objective in the 1995 WQCP to maintain water quality conditions and other measures "sufficient to achieve a doubling of natural production of chinook salmon from the average production of 1967–1991, consistent with the provisions of State and federal law." (AFRP, Page 98)

➔**Operational Target 1 (High Priority).** Close Delta Cross Channel (DCC) up to 45 days in the November through January period, when juvenile salmon enter the Delta or flow or turbidity changes trigger salmon migration. The DCC gates are to be closed within 24 hours when any of the following triggers occur:

1. daily average flow or turbidity of the Sacramento River at Freeport increases by 20% from the previous 3 day running average;

2. capture of at least one juvenile chinook salmon of spring-run size in the Sacramento River tributaries and in the Sutter Bypass, or in the Sacramento River at or below Knights Landing;

3. capture of at least two juvenile chinook salmon of any race in the Sacramento River at or below Knights Landing at any Interagency Ecological Program (IEP) sampling station in one day.

The gate closure period will be for 10, 15 and 20 consecutive days in November, December and January, respectively, and will remain closed for another 10 consecutive days if any of the above triggers are met after the initial closure for that month. Involved Parties: CALFED agencies. (AFRP, Page 99)

➔**Operational Target 2 (High Priority).** When the DCC is closed during the November through January period, limit the average State Water Project (SWP) and CVP exports to no greater than 35% of Delta inflow if Evaluation 3 determines that a relatively high ratio of Delta export to inflow limits juvenile salmon survival through the Sacramento River Delta. Sub-priorities: 1) January, 2) December, 3) November. Involved Parties: CALFED agencies. (AFRP, Page 100)

➔**Operational Target 3 (High Priority).** Maximize DCC closure from May 21 through June 15 when chinook salmon and other anadromous species are abundant in the lower Sacramento River, but keep open when the net benefit to striped bass and other sensitive species in the lower San Joaquin River is great. Involved Parties: CALFED agencies, United States Coast Guard, boating interests. (AFRP, Page 100)

➔**Operational Target 4 (High Priority).** Maintain an average export to inflow ratio of no more than 45% during February in dry years by increasing the ratio to ~55% in early February and decreasing the ratio to ~35% in late February, when winter-run chinook salmon smolts are present. Involved Parties: CALFED agencies. (AFRP, Page 100)

➔**Supplemental Action Requiring Water 6 (High Priority).** In conjunction with operation of a barrier at the head of Old River and consistent with efforts to conduct evaluations 1 and 2, maximize the difference between flows and export rates at levels greater than those required under the Delta smelt biological opinion during the 30-day April and May pulse flow period. Involved Parties: CALFED agencies. (AFRP, Page 101)

➔**Supplemental Action Requiring Water 7 (High Priority).** When a barrier at the head of Old River is not operational, limit the combined SWP and CVP exports to 1,500 cfs or maintain a Vernalis inflow to total export ratio of 5 to 1 during the 30-day April through May pulse flow period. Involved Parties: CALFED agencies. (AFRP, Page 101)

➔**Supplemental Action Requiring Water 8 (High Priority).** Increase the level of protection targeted by the May and June X2 (the location, measured in kilometers upstream of the Golden Gate Bridge, of 2 parts per thousand total dissolved solids) requirements to a 1962 level of development (LOD), as described below, where the number of days when X2 is required at Chipps Island in Table A of the 1995 WQCP is shown to the right of the requirements to meet a 1962 LOD and where PMI is the previous months eight river index in acre feet. Involved Parties: CALFED agencies. (AFRP, Page 102)

	1962 LOD		IN WQCP	
PMI	MAY	JUNE	MAY	JUNE
#1500	0	0	0	0
1750	1	0	0	0
2000	4	0	1	0
2250	13	1	3	0
2500	24	3	11	1
2750	29	7	20	2
3000	30	12	27	4
3250	31	18	29	8
3500	31	23	30	13
3750	31	26	31	18
4000	31	28	31	23
4250	31	29	31	25
4500	31	29	31	27
4750	31	30	31	28

➔**Supplemental Action Requiring Water 9 (High Priority).** During May, maintain at least 13,000 cfs daily flow in the Sacramento River at the I Street Bridge and 9,000 cfs at Knights Landing to improve transport of eggs and larval striped bass and other young anadromous fish and to reduce egg settling and mortality at low flows. Sub-priorities: 1) 13,000 cfs at I Street Bridge, 2) 9,000 cfs at Knights Landing. Involved Parties: CALFED agencies. (AFRP, Page 102)

➔**Supplemental Action Requiring Water 10 (High Priority).** During the last half of May, ramp (linearly) the total SWP and CVP export level from what it is at the end of the 30-day April and May pulse flow period to that export level proposed by the SWP and CVP to meet the requirements of the 1995 WQCP on June 1. Involved Parties: CALFED agencies. (AFRP, Page 103)

Supplemental Action Requiring Water 13 (High Priority). Supplement Delta outflow for migration and rearing of white sturgeon, green sturgeon, striped bass, and American shad by modifying CVP operations and using water available under the CVPIA (sections 3406[b][2] and [3]), consistent with actions to protect chinook salmon and steelhead. Involved Parties: CALFED agencies. (AFRP, Page 103)

Evaluation 7 (High Priority). Evaluate the benefits of short-term pulsed Delta inflows (five days or less) on the migration rate and survival of anadromous fish. Involved Parties: SWP and CVP contractors, IEP agencies. (AFRP, Page 106)

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

No flow-related actions listed.

Chapter 3. Mokelumne River

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Target 2: The target for the Mokelumne River is to provide conditions to maintain the fishery and riparian resources in good condition by implementing and evaluating the flow regime in the Joint Settlement Agreement (JSA) for Mokelumne River. The JSA provides increased flows below Camanche Dam beyond present requirements, which will benefit the fishery and riparian resources of the lower Mokelumne River (♦ ♦ ♦). (ERPP Vol. II, Page 341–342)

Programmatic Action 2A: Provide target flows for Mokelumne River storage releases, but only if there are sufficient inflows into storage reservoirs and carryover storage to meet target levels. The additional water would be obtained by developing new water supplies within the Central Valley basin, water transfers, and from willing sellers. (ERPP Vol. II, Page 342)

Programmatic Action 2B: Maintain or enhance summer and fall base flows on the Mokelumne River by developing new water supplies and by purchases from willing sellers. (ERPP Vol. II, Page 342)

Target 3: The target also is to provide enhanced streamflows below Woodbridge Dam by providing minimum flows recommended by CDFG in dry years: 200 cfs from November 1 through April 14; 250 cfs from April 15 through April 30; 300 cfs in May; and 20 cfs from June 1 through October 3 1, In normal years, minimum flows should be 250 cfs from October 1 through October 14; 300 cfs from October 15 through February 29; 350 cfs during March; 400 cfs during April; 450 cfs during May; 400 cfs during June; 150 cfs during July; and 100 cfs during August and September. In wet years, minimum flows should be 300 cfs from June 1 through October 14; 350 cfs from October 15 through February 29; 400 cfs in March; and 450 cfs during April and May (♦). (ERPP Vol. II, Page 342)

Target 4: A flow event should be provided on the Mokelumne River in late April or early May, averaging 500 to 1,000 cfs in dry years, 1,000 to 2,000 cfs in normal years, and 2,000 to 2,500 cfs in wet years (♦). (ERPP Vol. II, Page 342)

Programmatic Action 4A: Develop a cooperative feasibility study of opportunities to provide spring flow events. (ERPP Vol. II, Page 342)

ECOSYSTEM RESTORATION PROGRAM PLAN STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

Action 1 (High Priority). Supplement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to improve conditions for all life-history stages of chinook salmon and steelhead. Involved Parties: East Bay Municipal Utility District (EBMUD), State Water Resources Control Board (SWRCB), Woodbridge Irrigation District (WID), Federal Energy Regulatory Commission (FERC), CDFG, USFWS. (AFRP, Page 80)

Action 4 (High Priority). Reduce and control flow fluctuations to avoid and minimize adverse effects to juvenile salmonids. Involved Parties: CDFG, EBMUD. (AFRP, Page 80)

Evaluation 1 (High Priority). Evaluate the effectiveness of pulse flows to facilitate successful emigration of juvenile salmonids in the spring, and determine the efficacy in all water year types. Involved Parties: EBMUD, CDFG, USFWS, USBR. (AFRP, Page 81)

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Species and Life History–Stage Priorities

Table 1 shows the draft water allocation priorities for (b)(3) water on the Mokelumne River. The time periods in parentheses in the life history–stage column are approximate time periods when that life-history stage is present in the river. Actual time periods vary, dependent on run-timing, environmental conditions, and rate of development.

Table 1. Draft Water Allocation Priorities for (b)(3) Water on the Mokelumne River

Priority	Life-History Stage	Objective
1	Spawning and incubation (October through December)	Improve attraction flows and water temperatures for fall-run chinook salmon and steelhead migrating into and spawning and incubating in the Mokelumne River.
2	Incubation and Rearing (January through March)	Improve spawning, incubating, and rearing flows and related habitat conditions for fall- run chinook salmon and steelhead, and benefit sturgeon, striped bass, and other species through contribution to San Joaquin River flows and Delta outflows.
3	Rearing and outmigration (April through May)	Improve rearing and outmigration flows and related habitat conditions and provide adequate temperatures for fall-run chinook salmon in the Mokelumne River; and contribute to improved migration and spawning conditions for American shad. Also improve conditions for survival of San Joaquin basin and Delta tributary fall-run chinook salmon migrating through the San Joaquin River and the Delta, and benefit other riverine and estuarine species, including other anadromous fish, through contribution to San Joaquin River flows and Delta outflows.
4	Over-summering (June through September)	Improve rearing habitat for over-summering juvenile chinook salmon and steelhead.

Recommendations

Federal Energy Regulatory Commission Staff: The FERC staff alternative for minimum flows below Woodbridge Dam is based on an independent analysis of available data, including required Camanche conveyance releases, CDFG's 1991 Instream Flow Incremental Methodology (IFIM) study, and a temperature model (SNTMP) produced by the USFWS (Theurer et al. 1984). The staff integrated these habitat and temperature data to "optimally" allocate water for anadromous salmonids during two time periods. In October through February they attempt to maximize thermal conditions and weighted usable area (WUA) for upstream migration, spawning and incubation. A second priority is from May through June to maximize the same conditions for rearing and out-migration. In March through April when temperatures are not limiting, they reduce flows to maximize salmon rearing conditions based solely on the use of WUA values or physical habitat for juvenile rearing. FERC staff water-year types are based on a combination of end-of-the-year reservoir storage and unimpaired flow into Pardee Reservoir. Contrasting the 1996 Principles of Agreement (POA), FERC staff only identifies three water-year types: 1) dry, 2) below-normal, and 3) above-normal, but uses a similar fall (September 30) reservoir storage criteria for October through February releases. Starting in March they use the California Department of Water Resources' (DWR's) unimpaired runoff forecasts to identify March through September releases.

East Bay Municipal Utility District: EBMUD's recommendation for minimum instream flows derive from CDFG's 1991 IFIM study, and temperature modeling and fisheries studies conducted by Biosystems. EBMUD's recommendation focuses on improving upstream migration and spawning for chinook salmon and steelhead during the fall and winter months, as well as improved juvenile rearing habitat in the spring. Their general strategy recognizes natural

variation in stream flow and fish adaptations to these conditions. Critically dry year recommendations allow for intervening trap and haul operations of juvenile salmon downstream to presumed better habitat conditions. EBMUD defines three water-year types, 1) critically dry, 2) dry, and 3) normal and above, that are based solely on predicted and actual end-of-October storage conditions in Pardee and Camanche reservoirs. From May through October a combination of observed streamflow, snowpack, and storage volumes are used to predict end-of-October storage conditions. November through April releases at Camanche are based on actual reservoir storage at the end of October.

California Department of Fish and Game: CDFG's recommendation for minimum instream flows is based on a combination of WUA and discharge indices from their IFIM study, water temperature modeling, and knowledge of anadromous fish life stage requirements (see their 1991 Management Plan). Their plan places emphasis on using the natural hydrograph to guide flow recommendations by water-year type. Also unique to their recommendation are two blocks of water, in addition to set schedule flows, to be managed adaptively for attraction of fall spawners and spring outmigration of emigrating juveniles. Water years–dry, normal, and wet are defined solely on the basis of unimpaired runoff above Pardee Reservoir as described for the year in DWR's Bulletin 120 series May 1 report on water conditions. A dry year is considered less than half of the 50-year average for unimpaired runoff, normal is between 50% and 110% of the 50-year average, and wet years exceed 110% of the 50-year runoff. Additional fall attraction flows from October 1 to November 15 are 20 thousand acre feet (TAF) in normal and wet years, and 10 TAF in dry years. Likewise, additional outmigration flows from April 1 to June 30 are 10 TAF for normal and wet years and 5 TAF for dry years. AFRP considers these blocks of water together with the minimum recommended flow during corresponding time periods.

U. S. Fish and Wildlife Service: USFWS's 1993 recommendation allocates water for only two water-year types, dry and critically dry, and normal and wet. Dry and critically dry water years occur when observed inflows into Pardee Reservoir are less than 360 TAF for the water year, or when average annual flows are less than 500 cfs. Normal and wet year flows would be allocated when inflows are in excess of the above cut off. Similar to CDFG's recommendation, the USFWS places high priority on salmonid attraction flows by allocating an additional 15 TAF block of water during the first two weeks in October for normal and wet years. The flow allocation attempts to mimic the natural hyrograph with the allotted water.

AFRP Working Paper: The AFRP Working Paper recommends two sets of minimum instream flows, one set for salmon and steelhead and another for shad. The shad recommendation allocates water in addition to salmon flows during the April through May period for shad attraction, migration and spawning. The salmon recommendation uses three water-year types of wet, normal and dry. The shad recommendation splits normal into above-normal and below-normal, and adds a critical water year. Water-year types for Draft Water Right Decision 1630. Flows for October through January are based on the water-year type for the previous year.

Draft Guidelines for Allocation of Acquired Water

The following tables show the draft guidelines for allocation of acquired water on the Mokelumne River for each of the water-year types for which the existing standards were developed. The guidelines for each of the water-year types are bracketed on the lower end by the 1996 POA for the year type and on the upper end by the AFRP Working Paper flows that apply to the year type. Ultimately, AFRP expects that the upper-end bracket will be determined by the PEIS estimate of the amount of water available for acquisition, rather than by the Working Paper flows. Although these tables use the existing standards as the foundation to which the AFRP program adds acquired water, the AFRP expects that both the PEIS and the water acquisition program will consider the existing conditions to be the foundation.

Table 2 shows the draft guidelines for allocation of water acquired pursuant to Section 3406(b)(3) of the CVPIA for use on the Mokelumne River in critical water years. The time periods in parentheses in the targeted life history–stage column are approximate time periods when the block of water identified in the block of water column would be allocated for the benefit of the targeted life-history stage. Actual time periods will be based on real-time observations of run-timing, rate of development, and behavior of chinook salmon in the Mokelumne River. The block of water will be managed to maximize benefits to anadromous fish, both in the Mokelumne River and downstream, and in coordination with the Mokelumne River Technical Advisory Committee and downstream water managers. (AFRP Guidelines, Pages 38-40)

Table 2. Draft Guidelines for Allocation of Acquired Water for Use on the Mokelumne River in Critical Water Years

Priority	Targeted Life-History Stage	Block of Water (TAF)	Cumulative Total (TAF)	Support
1	Spawning and incubation (October through December)	3	3	1996 Principle of Agreement (POA) between the East Bay Municipal Utility District (EBMUD), the U.S. Fish and Wildlife Service (USFWS), and the California Department of Fish and Game (CDFG) for minimum flow releases to the lower Mokelumne River for a dry water year.
2	Rearing and outmigration (April through May)	13	16	POA minimum releases for a dry water year.
3	Over-summering (June through September)	1	17	POA minimum releases for a dry water year.
4	Spawning and incubation (October through December)	3	20	POA minimum releases for a below-normal water year.
5	Rearing and outmigration (April through June)	15	35	POA minimum releases for a below-normal water year.
6	Incubation and rearing (January through March)	4	39	POA minimum releases for a below-normal water year.

Priority	Targeted Life-History Stage	Block of Water (TAF)	Cumulative Total (TAF)	Support
7	Rearing and outmigration (April through June)	12	51	POA minimum releases for above-normal and wet water years.
8	Over-summering (July through September).	1	52	POA minimum releases for above-normal and wet water years.
9	Spawning and incubation (October through December)	7	59	EBMUD's 1993 recommended minimum releases from Camanche Reservoir to the lower Mokelumne River for a dry water year, (as cited in the Lower Mokelumne River Management Plan, prepared by Biosystems Analysis, Inc. 1993).
10	Rearing and outmigration (April through June)	14	73	EBMUD's 1993 recommended minimum releases for normal and wet water years.
11	Incubation and rearing (January through March)	7	80	Federal Energy Regulatory Commission (FERC) Final Environmental Impact Statement, 1993, staff recommended minimum releases for below-normal water years.
12	Spawning and incubation (October through December)	16	96	FERC (1993) staff recommended minimum releases for below-normal water years.
13	Over-summering (July through September).	4	100	FERC (1993) staff recommended minimum releases for below-normal water years.
14	Incubation and rearing (January through March)	10	110	CDFG (1991), Lower Mokelumne River Fisheries Management Plan recommended minimum releases for dry water years.
15	Over-summering (July through September).	3	113	U.S. Fish and Wildlife Service (USFWS) flow recommendation for the Lower Mokelumne River in critically dry and dry water years, letter submitted to FERC, 1993.
16	Incubation and rearing (January through March)	3	116	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year, without releases targeted specifically for American shad.
17	Over-summering (July through September).	8	124	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year, without releases targeted specifically for American shad.
18	Spawning and incubation (October through December)	17	141	FERC (1993) staff recommended minimum releases for above-normal water year.
19	Rearing and outmigration (April through June)	5	146	USFWS (1993) recommended minimum releases for normal and wet water years.
20	Incubation and rearing (January through March)	15	161	USFWS (1993) recommended minimum releases for normal and wet water years.
21	Spawning and incubation (October through December)	15	176	CDFG (1991) recommended minimum releases for normal water years.
22	Rearing and outmigration (April through June)	21	197	CDFG (1991) recommended minimum releases for normal water years.

Priority	Targeted Life-History Stage	Block of Water (TAF)	Cumulative Total (TAF)	Support
23	Incubation and rearing (January through March)	3	200	CDFG (1991) recommended minimum releases for normal water years.
24	Over-summering (July through September).	1	201	CDFG (1991) recommended minimum releases for normal water years.
25	Rearing and outmigration (April through June)	36	237	AFRP Working Paper (USFWS 1995) minimum releases for normal water years, without releases targeted specifically for American shad.
26	Incubation and rearing (January through March)	3	240	AFRP Working Paper (USFWS 1995) minimum releases for normal water years, without releases targeted specifically for American shad.
27	Spawning and incubation (October through December)	9	249	CDFG (1991) recommended minimum releases for a wet water year.
28	Incubation and rearing (January through March)	6	255	CDFG (1991) recommended minimum releases for a wet water year.
29	Over-summering (July through September).	34	289	CDFG (1991) recommended minimum releases for a wet water year.
30	Rearing and outmigration (April through June)	54	343	AFRP Working Paper (USFWS 1995) minimum releases for a wet water year, without releases targeted specifically for American shad.
31	Incubation and rearing (January through March)	18	361	AFRP Working Paper (USFWS 1995) minimum releases for a wet water year, without releases targeted specifically for American shad.

Table 3 shows guidelines for allocation of water acquired pursuant to Section 3406(b)(3) of the CVPIA for use on the Mokelumne River in dry water years. See the discussion of Table 2 for a more complete description of the columns.

Table 3. Guidelines for Allocation of Acquired Water for Use on the Mokelumne River in Dry Water Years

Priority	Targeted Life-History Stage	Block of Water (TAF)	Cumulative Total (TAF)	Support
1	Spawning and incubation (October through December)	3	3	POA minimum releases for a below normal water year.
2	Rearing and outmigration (April through May)	15	18	POA minimum releases for a below normal water year.
3	Incubation and rearing (January through March)	4	22	POA minimum releases for a below normal water year.
4	Rearing and outmigration (April through June)	12	34	POA minimum releases for above normal and wet water years.
5	Over-summering (July through September).	1	35	POA minimum releases for above normal and wet water years.

Priority	Targeted Life-History Stage	Block of Water (TAF)	Cumulative Total (TAF)	Support
6	Spawning and incubation (October through December)	7	42	EBMUD's 1993 recommended minimum releases for a dry water year.
7	Rearing and outmigration (April through May)	14	56	EBMUD's 1993 recommended minimum releases for normal and wet water years.
8	Incubation and rearing (January through March)	7	63	Federal Energy Regulatory Commission (FERC) Final Environmental Impact Statement, 1993, staff recommended minimum releases for below-normal water years.
9	Spawning and incubation (October through December)	16	79	FERC (1993) staff recommended minimum releases for below-normal water years.
10	Over-summering (July through September).	4	83	FERC (1993) staff recommended minimum releases for below-normal water years.
11	Incubation and rearing (January through March)	10	93	CDFG (1991), Lower Mokelumne River Fisheries Management Plan recommended minimum releases for dry water years.
12	Over-summering (July through September).	3	96	U.S. Fish and Wildlife Service (USFWS) flow recommendation for the Lower Mokelumne River in a critically dry and dry water years, letter submitted to FERC, 1993
13	Incubation and rearing (January through March)	3	99	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year, without releases targeted specifically for American shad.
14	Over-summering (July through September).	8	107	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year, without releases targeted specifically for American shad.
15	Spawning and incubation (October through December)	17	124	FERC (1993) staff recommended minimum releases for above-normal water year.
16	Rearing and outmigration (April through May)	5	129	USFWS (1993) recommended minimum releases for normal and wet water years.
17	Incubation and rearing (January through March)	15	144	USFWS (1993) recommended minimum releases for normal and wet water years.
18	Spawning and incubation (October through December)	15	159	CDFG (1991) recommended minimum releases for normal water years.
19	Rearing and outmigration (April through May)	21	180	CDFG (1991) recommended minimum releases for normal water years.
20	Incubation and rearing (January through March)	3	183	CDFG (1991) recommended minimum releases for normal water years.
21	Over-summering (July through September).	1	184	CDFG (1991) recommended minimum releases for normal water years.
22	Rearing and outmigration (April through May)	36	220	AFRP Working Paper (USFWS 1995) minimum releases for normal water years, without releases targeted specifically for American shad.

Priority	Targeted Life-History Stage	Block of Water (TAF)	Cumulative Total (TAF)	Support
23	Incubation and rearing (January through March)	3	223	AFRP Working Paper (USFWS 1995) minimum releases for normal water years, without releases targeted specifically for American shad.
24	Spawning and incubation (October through December)	9	232	CDFG (1991) recommended minimum releases for a wet water year.
25	Incubation and rearing (January through March)	6	238	CDFG (1991) recommended minimum releases for a wet water year.
26	Over-summering (July through September).	34	272	CDFG (1991) recommended minimum releases for a wet water year.
27	Rearing and outmigration (April through May)	54	326	AFRP Working Paper (USFWS 1995) minimum releases for a wet water year, without releases targeted specifically for American shad.
28	Incubation and rearing (January through March)	18	344	AFRP Working Paper (USFWS 1995) minimum releases for a wet water year, without releases targeted specifically for American shad.
29	Rearing and outmigration (April through May)	43	387	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year, including releases targeted specifically for American shad.

Table 4 shows the guidelines for allocation of water acquired pursuant to Section 3406(b)(3) of the CVPIA for use on the Mokelumne River in below normal water years. See the discussion of Table 2 for a more complete description of the columns.

Table 4. Guidelines for Allocation of Acquired Water for Use on the Mokelumne River in Below Normal Water Years

Priority	Targeted Life-History Stage	Block of Water (TAF)	Cumulative Total (TAF)	Support
1	Incubation and rearing (January through March)	12	12	POA minimum releases for above normal and wet water years.
2	Over-summering (July through September).	1	13	POA minimum releases for above normal and wet water years.
3	Spawning and incubation (October through December)	7	20	EBMUD's 1993 recommended minimum releases for a dry water year.
4	Rearing and outmigration (April through May)	14	34	EBMUD's 1993 recommended minimum releases for normal and wet water years.
5	Incubation and rearing (January through March)	7	41	Federal Energy Regulatory Commission (FERC) Final Environmental Impact Statement, 1993, staff recommended minimum releases for below-normal water years.
6	Spawning and incubation (October through December)	16	57	FERC (1993) staff recommended minimum releases for below-normal water years.

Priority	Targeted Life-History Stage	Block of Water (TAF)	Cumulative Total (TAF)	Support
7	Over-summering (July through September).	4	61	FERC (1993) staff recommended minimum releases for below-normal water years.
8	Incubation and rearing (January through March)	10	71	CDFG (1991), Lower Mokelumne River Fisheries Management Plan recommended minimum releases for dry water years.
9	Over-summering (July through September).	3	74	U.S. Fish and Wildlife Service (USFWS) flow recommendation for the Lower Mokelumne River in a critically dry and dry water years, letter submitted to FERC, 1993
10	Incubation and rearing (January through March)	3	77	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year, without releases targeted specifically for American shad.
11	Over-summering (July through September).	8	85	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year, without releases targeted specifically for American shad.
12	Spawning and incubation (October through December)	17	102	FERC (1993) staff recommended minimum releases for above-normal water year.
13	Rearing and outmigration (April through May)	5	107	USFWS (1993) recommended minimum releases for normal and wet water years.
14	Incubation and rearing (January through March)	15	122	USFWS (1993) recommended minimum releases for normal and wet water years.
15	Spawning and incubation (October through December)	15	137	CDFG (1991) recommended minimum releases for normal water years.
16	Rearing and outmigration (April through May)	21	158	CDFG (1991) recommended minimum releases for normal water years.
17	Incubation and rearing (January through March)	3	161	CDFG (1991) recommended minimum releases for normal water years.
18	Over-summering (July through September).	1	162	CDFG (1991) recommended minimum releases for normal water years.
19	Rearing and outmigration (April through May)	36	198	AFRP Working Paper (USFWS 1995) minimum releases for normal water years, without releases targeted specifically for American shad.
20	Incubation and rearing (January through March)	3	201	AFRP Working Paper (USFWS 1995) minimum releases for normal water years, without releases targeted specifically for American shad.
21	Spawning and incubation (October through December)	9	210	CDFG (1991) recommended minimum releases for a wet water year.
22	Incubation and rearing (January through March)	6	216	CDFG (1991) recommended minimum releases for a wet water year.
23	Over-summering (July through September).	34	250	CDFG (1991) recommended minimum releases for a wet water year.

Priority	Targeted Life-History Stage	Block of Water (TAF)	Cumulative Total (TAF)	Support
24	Rearing and outmigration (April through May)	54	304	AFRP Working Paper (USFWS 1995) minimum releases for a wet water year, without releases targeted specifically for American shad.
25	Incubation and rearing (January through March)	18	322	AFRP Working Paper (USFWS 1995) minimum releases for a wet water year, without releases targeted specifically for American shad.
26	Rearing and outmigration (April through May)	43	365	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year, including releases targeted specifically for American shad.
27	Rearing and outmigration (April through May)	114	479	AFRP Working Paper (USFWS 1995) minimum releases for a below-normal water year, including releases targeted specifically for American shad.

Table 5 shows the guidelines for allocation of water acquired pursuant to Section 3406(b)(3) of the CVPIA for use on the Mokelumne River in above normal and wetter water years. See the discussion of Table 1 for a more complete description of the columns.

Table 5. Guidelines for Allocation of Acquired Water for Use on the Mokelumne River in Above Normal and Wetter Water Years

Priority	Targeted Life-History Stage	Block of Water (TAF)	Cumulative Total (TAF)	Support
1	Incubation and rearing (January through March)	7	7	POA minimum releases for above normal and wet water years.
2	Over-summering (July through September).	14	21	POA minimum releases for above normal and wet water years.
3	Spawning and incubation (October through December)	7	28	EBMUD's 1993 recommended minimum releases for a dry water year.
4	Rearing and outmigration (April through May)	16	44	EBMUD's 1993 recommended minimum releases for normal and wet water years.
5	Incubation and rearing (January through March)	4	48	Federal Energy Regulatory Commission (FERC) Final Environmental Impact Statement, 1993, staff recommended minimum releases for below-normal water years.
6	Spawning and incubation (October through December)	10	58	FERC (1993) staff recommended minimum releases for below-normal water years.
7	Over-summering (July through September).	3	61	FERC (1993) staff recommended minimum releases for below-normal water years.
8	Incubation and rearing (January through March)	3	64	CDFG (1991), Lower Mokelumne River Fisheries Management Plan recommended minimum releases for dry water years.
9	Over-summering (July through September).	8	72	U.S. Fish and Wildlife Service (USFWS) flow recommendation for the Lower Mokelumne River in a critically dry and dry water years, letter submitted to FERC, 1993

Priority	Targeted Life-History Stage	Block of Water (TAF)	Cumulative Total (TAF)	Support
10	Incubation and rearing (January through March)	17	89	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year, without releases targeted specifically for American shad.
11	Over-summering (July through September).	5	94	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year, without releases targeted specifically for American shad.
12	Spawning and incubation (October through December)	15	109	FERC (1993) staff recommended minimum releases for above-normal water year.
13	Rearing and outmigration (April through May)	15	124	USFWS (1993) recommended minimum releases for normal and wet water years.
14	Incubation and rearing (January through March)	21	145	USFWS (1993) recommended minimum releases for normal and wet water years.
15	Spawning and incubation (October through December)	3	148	CDFG (1991) recommended minimum releases for normal water years.
16	Rearing and outmigration (April through May)	1	149	CDFG (1991) recommended minimum releases for normal water years.
17	Incubation and rearing (January through March)	36	185	CDFG (1991) recommended minimum releases for normal water years.
18	Over-summering (July through September).	3	188	CDFG (1991) recommended minimum releases for normal water years.
19	Rearing and outmigration (April through May)	9	197	AFRP Working Paper (USFWS 1995) minimum releases for normal water years, without releases targeted specifically for American shad.
20	Incubation and rearing (January through March)	6	203	AFRP Working Paper (USFWS 1995) minimum releases for normal water years, without releases targeted specifically for American shad.
21	Spawning and incubation (October through December)	34	237	CDFG (1991) recommended minimum releases for a wet water year.
22	Incubation and rearing (January through March)	54	291	CDFG (1991) recommended minimum releases for a wet water year.
23	Over-summering (July through September).	18	309	CDFG (1991) recommended minimum releases for a wet water year.
24	Rearing and outmigration (April through May)	43	352	AFRP Working Paper (USFWS 1995) minimum releases for a wet water year, without releases targeted specifically for American shad.
25	Incubation and rearing (January through March)	114	466	AFRP Working Paper (USFWS 1995) minimum releases for a wet water year, without releases targeted specifically for American shad.
26	Rearing and outmigration (April through May)	49	515	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year, including releases targeted specifically for American shad.
27	Rearing and outmigration (April through May)	123	638	AFRP Working Paper (USFWS 1995) minimum releases for a below-normal water year, including releases targeted specifically for American shad.

Chapter 4. Cosumnes River

ECOSYSTEM RESTORATION PROGRAM PLAN VOL. II

Ecological Processes, Central Valley Streamflows

Target 1: For the Cosumnes River, where a natural streamflow pattern presently exists with natural winter and spring streamflows, the target is to maintain or restore natural summer and fall base flows (♦♦). (ERPP Vol. II, Page 341)

Programmatic Action 1A: Improve summer and fall base flows on the Cosumnes River by developing new water supplies along the river and by purchases from willing sellers. (ERPP Vol. II, Page 341)

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

Action 1 (High Priority). Acquire water from willing sellers consistent with applicable guidelines or negotiate agreements to reduce water diversions or augment instream flows during critical periods for salmonids. Involved Parties: Diverters, CDFG, USFWS, USBR. (AFRP, Page 82)

Action 2 (High Priority). Pursue opportunities to purchase existing water rights from willing sellers consistent with applicable guidelines to ensure adequate flows for all life stages of salmonids. Involved Parties: CDFG, The Nature Conservancy (TNC), USFWS, USBR. (AFRP, Page 82)

Evaluation 1 (High Priority). Determine and evaluate instream flow requirements that ensure adequate flows for all life stages of all salmonids. Involved Parties: Diverters, TNC, CDFG, USFWS, USBR. (AFRP, Page 83)

U.S. FISH AND WILDLIFE SERVICE DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CENTRAL VALLEY PROJECT IMPROVEMENT ACT

Not included in the guidelines.

Chapter 5. Calaveras River

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Target 5: For the Calaveras River, where the natural streamflow has been greatly altered, streamflows should be enhanced below New Hogan Dam by the minimum flows recommended by CDFG (♦). (ERPP Vol. II, Page 342)

Programmatic Action 5A: Provide target flows for the Calaveras River from storage releases, but only if there are sufficient inflows into storage reservoirs and carryover storage to meet target levels. The additional water would be obtained by developing new water supplies within the Central Valley basin, water transfers, and from willing sellers. (ERPP Vol. II, Page 342)

Programmatic Action 5C: Cooperatively evaluate the potential for resizing criteria at New Hogan Reservoir on the Calaveras River to yield additional water for instream flow needs while maintaining or improving flood control requirements. (ERPP Vol. II, Page 342)

Programmatic Action 5D: A flow event should be provided in late February or early March,, averaging 100 to 200 cfs in dry years, 300 to 400 cfs in normal years, and 600 to 800 cfs in wet years. Such flows would be provided only when inflows to New Hogan Reservoir are at these levels. (ERPP Vol. II, Page 342)

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

Action 1 (High Priority). Supplement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to improve conditions for all life-history stages of chinook salmon. Involved Parties: Calaveras County Water District, Stockton

East Water District (SEWD), CDFG, U.S. Army Corps of Engineers (COE), USFWS, USBR. (AFRP, Page 84)

Action 2 (High Priority). Provide flows of suitable water temperatures for all salmonid life stages. Involved Parties: CDFG, USFWS, USBR. (AFRP, Page 84)

Evaluation 2 (High Priority). Evaluate instream flow, water temperature and fish habitat use in the Calaveras River to develop a real-time management program so that reservoir operations can maintain suitable habitat when fish are present. Involved Parties: CDFG, Diverters, USFWS. (AFRP, Page 85)

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Species and Life History–Stage Priorities

On the Calaveras River, the primary species of concern is winter-run chinook salmon. Table 1 prioritizes life-history stages for winter-run chinook salmon.

Table 1. Life-History Stages for Winter-Run Chinook Salmon on the Calaveras River

Priority	Life-History Stage	Objective
1	Adult migration (February through April).	Improve attraction flows for winter-run chinook salmon migrating into the Calaveras River.
2	Spawning and incubation (May through July)	Improve spawning and incubation flows and related habitat conditions for winter-run chinook salmon, and benefit sturgeon, striped bass, and other species through contribution to Delta outflows.
3	Incubation and rearing (August through October)	Improve incubation and rearing flows and related habitat conditions for winter-run chinook salmon in the Calaveras River; and contribute to improved conditions for survival, and contribution to Delta outflows.
4	Rearing and outmigration (November through January)	Improve rearing habitat and survival of emigrants.

Recommendations

The AFRP Working Paper (USFWS 1995) identified flows for three water-year types (critical and dry, below and above normal, and wet) based on results of a preliminary instream flow study conducted by USFWS (Memorandum to the U. S. Bureau of Reclamation re: Stanislaus River basin–Calaveras River conjunctive use water program study: a preliminary evaluation of fish and wildlife impacts with emphasis on water needs of the Calaveras River 1993) that indicated winter-run chinook salmon require flows of 50 to 225 cfs.

Draft Guidelines for Allocation of Acquired Water

Table 3[1] shows draft guidelines for allocation of water acquired pursuant to Section 3406(b)(3) of the CVPIA for use on the Calaveras River. The time periods in parentheses in the targeted life history–stage column are approximate time periods when the block of water identified in the block of water column would be allocated for the benefit of the targeted life-history stage. Actual time periods will be based on real-time observations of run-timing, rate of development, and behavior of chinook salmon in the Calaveras River. The block of water will be managed to maximize benefits to anadromous fish, both in the Calaveras River and downstream, and in coordination with downstream water managers.

Table 3. Draft Guidelines for Allocation of Acquired Water for Use on the Calaveras River

Priority	Targeted Life-History Stage	Block of Water (TAF)	Cumulative Total (TAF)	Support
1	Adult migration (February through April).	21	21	AFRP Working Paper (USFWS 1995) minimum releases for a critical and dry water year.
2	Spawning and incubation (May through July)	22	43	AFRP Working Paper (USFWS 1995) minimum releases for a critical and dry water year.
3	Incubation and rearing (August through October)	20	63	AFRP Working Paper (USFWS 1995) minimum releases for a critical and dry water year.
4	Rearing and outmigration (November through January)	9	72	AFRP Working Paper (USFWS 1995) minimum releases for a critical and dry water year.
5	Adult migration (February through April).	6	78	AFRP Working Paper (USFWS 1995) minimum releases for a below normal and above normal water year.
6	Spawning and incubation (May through July)	7	85	AFRP Working Paper (USFWS 1995) minimum releases for a below normal and above normal water year.
7	Incubation and rearing (August through October)	4	89	AFRP Working Paper (USFWS 1995) minimum releases for a below normal and above normal water year.
8	Rearing and outmigration (November through January)	4	93	AFRP Working Paper (USFWS 1995) minimum releases for a below normal and above normal water year.
9	Adult migration (February through April).	6	99	AFRP Working Paper (USFWS 1995) minimum releases for a wet water year.
10	Spawning and incubation (May through July)	7	106	AFRP Working Paper (USFWS 1995) minimum releases for a wet water year.

[1] Table 2, described in the Draft Guidelines as draft guidelines for allocation of acquired water based on flows recommended for three water- year types on the Calaveras River (critical and dry, below and above normal, and wet) was not contained in the Draft Guidelines and is therefore not presented here.

Priority	Targeted Life-History Stage	Block of Water (TAF)	Cumulative Total (TAF)	Support
11	Incubation and rearing (August through October)	3	109	AFRP Working Paper (USFWS 1995) minimum releases for a wet water year.

Chapter 6. Mokelumne, Cosumnes, and Calaveras Rivers (Combined)

ERPP VOL. II

Ecological Processes, Course Sediment Supply

Target 3: Restore gravel transport and cleaning processes to attain sufficient high quality salmon spawning habitat in each of the three streams for target population levels (♦). (ERPP Vol. II, Page 344)

Programmatic Action 3A: Develop a cooperative program to provide late winter or early spring flow events, as needed, to establish appropriate flushing/channel maintenance flows. (ERPP Vol. II, Page 344)

Ecological Processes, Central Valley Stream Temperatures

Target 1: Maintain mean daily water temperatures at or below levels suitable for all life stages of fall-run chinook salmon and steelhead (♦♦). (ERPP Vol. II, Page 345)

Programmatic Action 1 A: Cooperatively evaluate the feasibility of releasing sufficient instream flows to improve temperature conditions for key resources in the Mokelumne and Calaveras Rivers. (ERPP Vol. II, Page 345)

Programmatic Action 1 D: Manage Pardee and Camanche Reservoirs through October to maintain a cold water volume of 28,000 acre-feet (af) when Pardee Reservoir volume exceeds 100,000 af. (ERPP Vol. II, Page 346)

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

No flow-related actions listed.

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Not included in the guidelines.

Chapter 7. Suisun Marsh/North San Francisco Bay

ERPP VOL. II

The Suisun Marsh/North San Francisco Bay Ecological Management Zone is the westernmost zone of the Ecosystem Restoration Program. Its eastern boundary is the Collinsville area, and to the west it is bounded by the northwestern end of San Pablo Bay. The northern boundary follows the ridge tops of the Coast Ranges and includes the Petaluma River, Sonoma Creek, the Napa River, Suisun Bay and marsh and San Pablo Bay. This Ecological Management Zone is composed of five Ecological Management Units:

- # Suisun Bay and Marsh,
- # Napa River,
- # Sonoma Creek,
- # Petaluma River, and
- # San Pablo Bay.

Ecological Processes, Central Valley Streamflow (Freshwater Inflow)

Target 1: More closely emulate the natural seasonal freshwater inflow pattern to North San Francisco Bay to:

- # transport sediments,
- # allow upstream and downstream fish passage,
- # contribute to riparian vegetation succession,
- # permit transport of larval fish to the entrapment zone,
- # maintain the low salinity zone in Suisun Bay, and
- # provide adequate attraction flows for upstream, through-Bay migrating salmon.

Delta outflow in dry and normal years will be improved by coordinating releases and natural flows in the Sacramento River Basin to provide a March flow event of at least 20,000 cfs for 10 days in dry years, at least 30,000 cfs for 10 days in below-normal years, and at least 40,000 cfs for 10 days in above-normal years. The existing smaller, late-April and early-May flow event will be improved with additional water releases from San Joaquin River and Delta tributaries to provide flows of magnitudes and durations similar to those prescribed for March (♦♦). (ERPP Vol. II, Page 143)

Programmatic Action 1A: Develop a cooperative program to provide target flows in dry and normal years by allowing inflows to major storage reservoirs, prescribed in the visions of upstream Ecological Management Zones, to pass downstream into and through the Delta. (This action would result from an accumulation of recommendations for spring flow events and minimum flows from upstream Ecological Management Zones.) (ERPP Vol. II, Pages 143–144)

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

No flow-related actions listed.

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Not included in the guidelines.

Chapter 8. Sacramento River

ERPP VOL. II

The Sacramento River Ecological Management Zone includes 242 miles of the mainstem Sacramento River from Keswick Dam near Redding to the American River at Sacramento. (The remaining 60 miles of the lower river downstream of Sacramento are included in the North Delta Ecological Management Unit.)

Ecological Processes, Central Valley Streamflows

Target 1: More closely emulate the seasonal streamflow patterns in dry and normal year-types by allowing a late-winter or early-spring flow event of approximately 8,000 to 10,000 cfs in dry years and 15,000 to 20,000 cfs in below normal water-years to occur below Keswick Dam (♦♦). (ERPP Vol. II. Pages 175–176)

Programmatic Action IA: Provide a flow event by supplementing normal operating flows from Shasta and Keswick Dams in March during years when no flow event has occurred during winter or is expected to occur. Flow events would be provided only when sufficient inflow to Lake Shasta is available to sustain the prescribed releases. This action can be refined by evaluating its indirect costs and the overall effectiveness of achieving objectives. (ERPP Vol. II, Page 176)

Target 2: Maintain base flows of 6,000 to 8,000 cfs during fall (♦). (ERPP Vol. II, Page 176)

Programmatic Action 2A: Provide flow releases from Shasta Lake and Keswick Dam when necessary to provide the target base flows. Releases would be made only when inflows equal or exceed prescribed releases. (ERPP Vol. II, Page 176)

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

➔**Action 1 (High Priority).** Implement a river flow regulation plan that balances carryover storage needs with instream flow needs consistent with the 1993 biological opinion for winter-run chinook salmon based on runoff and storage conditions, including the following minimum recommended flows at Keswick and Red Bluff Diversion dams. Involved Parties: USFWS, USBR, National Marine Fisheries Service (NMFS), CDFG, Tehama-Colusa Canal Authority (TCCA). (AFRP, Page 35)

Recommended minimum Sacramento River flows (cfs) at Keswick Dam for October 1 to April 30 based on October 1 carryover in Shasta Reservoir and critically dry runoff conditions (driest decile runoff of 2.5 maf) to produce a target April 30 Shasta Reservoir storage of 3.0–3.2 maf for temperature control.

Carryover storage (maf)	Keswick release (cfs)
1.9 to 2.1	3,250
2.2	3,500
2.3	3,750
2.4	4,000
2.5	4,250
2.6	4,500
2.7	4,750
2.8	5,000
2.9	5,250
3	5,500

➔**Action 2 (High Priority).** Implement a schedule for flow changes that avoids, to the extent controllable, dewatering redds and isolating or stranding juvenile anadromous salmonids, consistent with SWRCB Order 90-5. Involved Parties: USFWS, USBR, CDFG, SWRCB, NMFS. (AFRP, Page 36)

➔**Evaluation 1 (High Priority).** Continue study to refine a river regulation program, consistent with SB 1086, that balances fish habitats with the flow regime and addresses temperatures, flushing flows, attraction flows, emigration, channel and riparian corridor maintenance. Involved Parties: USFWS, USBR, CDFG, SWRCB, NMFS, USRFRHAC. (AFRP, Page 39)

➔**Evaluation 2 (High Priority).** Evaluate opportunities to incorporate flows to restore riparian vegetation from Keswick Dam to Verona that are consistent with the overall river regulation plan. Involved Parties: USFWS, USBR, NMFS, CDFG, USRFRHAC. (AFRP, Page 39)

➔**Evaluation 6 (High Priority).** Identify and attempt to maintain adequate flows for white sturgeon and green sturgeon from February to May for spawning, emigration, egg incubation and rearing, consistent with actions to protect chinook salmon and steelhead and when hydrologic conditions are adequate to minimize adverse effects to water supply operations. Involved Parties: USFWS, USBR, NMFS, CDFG. (AFRP, Page 40)

➔**Evaluation 7 (High Priority).** Identify and attempt to maintain adequate flows from April to June for spawning, incubation, and rearing of American shad, consistent with actions to

protect chinook salmon and steelhead and when hydrologic conditions are adequate to minimize adverse effects to water supply operations. Involved Parties: USFWS, USBR, NMFS, CDFG. (AFRP, Page 40)

Evaluation 8 (High Priority). Identify and implement actions that will maintain mean daily water temperatures between 61F and 65F for at lease one month between April 1 and June 30 for American shad spawning below RBDD, consistent with actions to protect chinook salmon and steelhead and when hydrologic conditions are adequate to minimize adverse effects to water supply operations. Involved Parties: USFWS, USBR, NMFS, CDFG. (AFRP, Page 40)

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Not included in the guidelines.

Chapter 9. North Sacramento Valley

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Programmatic Target: More closely emulate the seasonal streamflow patterns in Clear, Cow, and Battle Creeks in most year types by providing or maintaining flows that mobilize and transport sediments, allow upstream and downstream fish passage, create point bars, and contribute to stream channel meander and riparian vegetation succession. (ERPP Vol. II, Page 202)

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

No flow-related actions listed.

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Not included in the guidelines.

Chapter 10. Clear Creek

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Target 2: Increase flow in Clear Creek to 150 to 200 cfs from October 1 to May 31 and to 100 to 150 cfs from June 1 to September 30 (♦♦). (ERPP Vol. II, Page 202)

Programmatic Action 2A: Develop a cooperative program to improve flow in Clear Creek by increasing releases from Clair Hill and Whiskeytown Dams. (ERPP Vol. II, Page 202)

Ecological Processes, Central Valley Stream Temperatures

Target 1: Maintain suitable water temperatures in Clear Creek for spring-run chinook and steelhead holding, spawning, and rearing (♦♦♦). (ERPP Vol. II, Page 202)

Programmatic Action 1A: Maintain 56º F to approximately 3 miles downstream of McCormick-Saeltzer Dam from June through September. (♦♦). (ERPP Vol. II, Page 203) RATIONALE: Whiskeytown Dam provides an excellent opportunity to provide cold water releases from the lower depths of the reservoir to maintain adequate temperatures in downstream reaches. Because salmon and steelhead cannot access the higher quality habitat in Clear Creek because of the blockage at McCormick-Saeltzer Dam, greater releases will need to be made from Whiskeytown Dam to provide adequate temperatures in the reach below McCormick-Saeltzer Dam. Preliminary results from an ongoing temperature modeling study indicate that the AFRP recommended flows have the potential to provide adequate temperatures for spring-run chinook and steelhead in most of the reach between Whiskeytown and McCormick-Saeltzer dams. However, higher releases are necessary to achieve adequate temperatures below McCormick-Saeltzer Dam, and should be provided until McCormick-Saeltzer Dam is removed or modified to allow passage. (ERPP Vol. II, Page 203)

Eliminating or Reducing Stressors, Water Diversions

Target 2: Reduce or eliminate conflicts between the diversion of water and chinook salmon and steelhead populations at all diversions on Clear Creek (♦ ♦ ♦). (ERPP Vol. II, Page 205)

Programmatic Action 2A: Acquire water rights on Clear Creek at the McCormick Dam to eliminate the need for diversion. (ERPP Vol. II, Page 205)

ERPP STRATEGIC PLAN, APPENDIX D

Action 4. Provide sufficient scouring flows to periodically remove vegetation that has encroached within the active channel in lower Clear Creek, and mechanically remove vegetation if necessary. (Strategic Plan, Page D-23)

Action 6. Evaluate the need to augment flows in Clear Creek and acquire water from willing sellers. (This water will be part of the 100 TAF acquired to improve streamflow in the Sacramento and San Joaquin Basins.) (Strategic Plan, Page D-24)

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

Clear Creek is an AFRP high priority creek.

➔**Action 1 (High Priority).** Release 200 cfs October 1 to June 1 from Whiskeytown Dam for spring-, fall- and late fall–run chinook salmon spawning, egg incubation, emigration, gravel restoration, spring flushing and channel maintenance; release 150 cfs, or less, from July through September to maintain 60ºF temperatures in stream sections utilized by spring-run chinook salmon. Both releases should be within the average total annual unimpaired flows to the Clear Creek watershed. Involved Parties: CDFG, USFWS, USBR, SWRCB. (AFRP, Page 41)

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Not included in the guidelines.

Chapter 11. Cow Creek

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Target 1: Increase flow in Cow Creek by 25 to 50 cfs, corresponding to the natural seasonal runoff pattern, and maintain 25 to 75 cfs during October (♦♦). (ERPP Vol. II, Page 202)

Programmatic Action 1A: Increase flow in Cow Creek by purchasing water from willing sellers or implementing a conjunctive groundwater program. (ERPP Vol. II, Page 202)

Eliminating or Reducing Stressors, Dams and Other Structures

TARGET 1: Work with landowners and diverters on Cow Creek to reduce the adverse effects of 13 seasonal diversion dams in South Cow Creek, 10 diversion dams in Old Cow Creek, two diversion dams in North Cow Creek, and one diversion dam in Clover Creek that are barriers to migrating chinook salmon and steelhead. This would allow access to 100% of the habitat below any natural bedrock falls (♦♦♦). (ERPP Vol. II, Page 206)

PROGRAMMATIC ACTION 1A: Improve passage conditions on Cow Creek by acquiring water rights from willing sellers, removing diversions, or providing alternative sources of water during important periods. (ERPP Vol. II, Page 206)

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

Action 1 (High Priority). Supplement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to provide flows for suitable passage and spawning for fall-run chinook salmon adults and adequate summer rearing habitat for juvenile steelhead. Involved Parties: Diverters, CDFG, USFWS, USBR, SWRCB. (AFRP, Page 43)

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Not included in the guidelines.

Chapter 12. Bear Creek

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Target 4: Augment flow in Bear Creek by 10 to 20 cfs (♦).(ERPP Vol. II, Page 202)

Programmatic Action 4A: Increase Bear Creek flow by purchasing water from willing sellers or providing alternative sources of water to diverters during important fish-passage periods in spring and fall. (ERPP Vol. II, Page 202)

Eliminating or Reducing Stressors, Dams and Other Structures.

Target 2: Work with landowners and diverters on Bear Creek to reduce the adverse effects of dewatering the stream channel at seasonal diversion dams, which results in no passage for migrating chinook salmon (♦ ♦ ♦). (ERPP Vol. II, Page 206),

Programmatic Action 2A: Improve passage and habitat conditions in Bear Creek by acquiring water rights from willing sellers, evaluating the removal of diversion dams, or providing alternative sources of water during important periods. (ERPP Vol. II, Page 206)

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

Action 1 (High Priority). Supplement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to allow suitable passage of juvenile and adult chinook salmon and steelhead during spring and early fall. Involved Parties: Diverters, CDFG, USFWS, USBR. (AFRP, Page 44)

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Not included in the guidelines.

Chapter 13. Battle Creek

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Target 3: Augment flow in Battle Creek by 25 to 50 cfs (♦ ♦).(ERPP Vol. II, Page 202)

Programmatic Action 3A: Increase flow in Battle Creek by purchasing water from willing sellers or providing compensation for forgone power production. This includes negotiating and renewing an existing interim flow agreement between the Department of the Interior and PG&E, and includes a provision for the release of 10 cfs at the Asbury Pump on Baldwin Creek, a dewatered Battle Creek tributary that provides steelhead habitat. In the longer-term, this action also includes increasing flows at the Inskip Diversion Dam and South Diversion Dam. (ERPP Vol. II, Page 202)

Eliminating or Reducing Stressors, Water Diversions

Target 1: Reduce or eliminate conflicts between the diversion of water and chinook salmon and steelhead populations at all diversion sites on Battle Creek (♦ ♦ ♦). (ERPP Vol. II, Page 205)

Programmatic Action IA: Develop a cooperative approach to improve conditions for anadromous fish in Battle Creek by installing fish screens at diversions on the North Fork, three diversions on the South Fork, and one diversion on the mainstem, or acquire water rights to eliminate the need for diversion and screening. (ERPP Vol. II, Page 205)

ERPP STRATEGIC PLAN, APPENDIX D

Action 2. Improve instream flows in lower Battle Creek to provide adequate passage flows. (Strategic Plan, Page D-27)

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

Battle Creek is an AFRP high priority creek.

➔**Action 2 (High Priority).** Acquire water from willing sellers consistent with applicable guidelines or negotiate agreements to increase flows past Pacific Gas and Electric Company's (PG&E's) hydropower diversions in two phases to provide adequate holding, spawning and rearing habitat for anadromous salmonids. Involved Parties: CDFG, PG&E, USFWS, USBR, NMFS, FERC. (AFRP, Page 47)

Diversion	Months	Flow (cfs)[c]
Keswick ditch [b]	All year	30
North Battle Creek feeder [b]	September–November	40
	January–April	40
	May–August	30
Eagle Canyon [a]	May–November	30
	December–April	30
Wildcat [a]	May–November	30
	December–April	50
South [b]	May–November	30
	December–April	40
Inskip [b]	May–November	30
	December–April	40
Coleman	September–April	50
	May–August	30

[a] First phase flows required to support winter- and spring-run chinook salmon between the Coleman Powerhouse and Eagle Canyon Diversion Dams while a disease-safe water supply is being developed for CNFH.

[b] Second phase flows required to support fall-run chinook salmon and steelhead above the CNFH weir, Coleman Powerhouse and Eagle Canyon Diversion Dams, after a disease-safe water supply is available to CNFH.

[c] Flows are intended as indicators of magnitude and subject to revision based on additional analyses.

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Not included in the guidelines.

Chapter 14. Cottonwood Creek

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Target 1: During summer and fall, more closely emulate the seasonal streamflow pattern, so that flows are sufficient for chinook salmon holding and spawning in most year types by providing up to 20 to 50 cfs. These flows, can mobilize and transport sediments, allow upstream and downstream fish passage, create point bars, and contribute to stream channel meander and riparian vegetation succession (♦). (ERPP Vol. II, Page 216)

Programmatic Action 1A: Augment summer and fall flow in Cottonwood Creek by purchasing water from willing sellers and developing alternative supplies. (ERPP Vol. II, Page 216)

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

No flow-related actions listed.

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Not included in the guidelines.

Chapter 15. Colusa Basin

ERPP VOL. II

No flow-related actions listed.

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

Colusa Basin Drain (Westside Tributaries)

Evaluation 1 (Medium Priority). Investigate the feasibility of restoring the access of anadromous fish to westside tributaries through development of defined migrational routes, sufficient flows, and adequate water temperatures. Involved Parties: CDFG, USFWS, USBR. (AFRP, Page 68)

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Not included in the guidelines.

Chapter 16. Stony Creek

ERPP VOL. II

No flow-related actions listed.

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

Evaluation 1 (High Priority). Determine the feasibility of restoring anadromous salmonids by evaluating water releases from Black Butte Dam, water exchanges with the Tehama-Colusa Canal, interim and long-term water diversion solutions at Red Bluff Diversion Dam, water quality improvements, spawning gravel protection and restoration, riparian habitat protection and restoration, creek channel creation, and passage improvements at water diversions. Involved Parties Stony Creek Task Force, TCCA, CDFG, COE, USFWS, USBR. (AFRP, Page 57)

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Not included in the guidelines.

Chapter 17. Butte Basin

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Target 7: Develop and implement comprehensive watershed management programs to protect water quality, increase summer base flows, and protect and restore other resources such as riparian vegetation (♦).(ERPP Vol. II, Page 249)

Programmatic Action 7A: Support local groups in funding and developing watershed management plans including support for watershed coordinators. (ERPP Vol. II, Page 249)

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

No flow-related actions listed.

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Not included in the guidelines.

Chapter 18. Butte Creek

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Target 5: Increase flow in Butte Creek (♦ ♦). (ERPP Vol. II, Page 249)

Programmatic Action 5A: Develop a cooperative approach to increase flow in Butte Creek by acquiring water from willing sellers. (ERPP Vol. II, Page 249)

Target 6: Maintain a minimum year-round flow of 40 cfs in Butte Creek between the Centerville Diversion Dam and the Centerville Powerhouse (♦ ♦ ♦). (ERPP Vol. II, Page 249)

Programmatic Action 6A: Develop a cooperative program with PG&E to maintain a minimum flow in Butte Creek below the Centerville Diversion Dam. (ERPP Vol. II, Page 249)

ERPP STRATEGIC PLAN, APPENDIX D

Action 2. Improve instream flows by purchasing water from willing sellers or providing alternative water supplies that will allow diverters to reduce diversions. (Note: this water will be part of the 100 TAF of water purchased to improve stream flows in the Sacramento and San Joaquin Basins. (Strategic Plan, Page D-30)

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

Butte Creek is an AFRP high priority creek.

➔**Action 1 (High Priority).** Obtain additional instream flows from Parrott-Phelan Diversion. Involved Parties: Diverters, Butte Creek Watershed Conservancy (BCWC), CDFG, USFWS, USBR. (AFRP, Page 60)

➔**Action 2 (High Priority).** Maintain a minimum 40 cfs instream flow below Centerville Diversion Dam. Involved Parties: BCWC, CDFG, PG&E, USFWS, USBR. (AFRP, Page 60)

➔**Action 3 (High Priority).** Purchase existing water rights from willing sellers. Involved Parties: Diverters, BCWC, CDFG, USFWS, USBR, SWRCB. (AFRP, Page 61)

➔**Action 8.** As available, acquire water rights as a part of the Western Canal Siphon project. Involved Parties: Western Canal Water District (WCWD), BCWC, CDFG, SWRCB, USBR. (AFRP, Page 62)

Action 9. Adjudicate water rights and provide water master service for the entire creek. Involved Parties: Diverters, BCWC, CDFG, DWR, SWRCB, USFWS, USBR. (AFRP, Page 62)

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Not included in the guidelines.

Chapter 19. Paynes Creek

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Target 1: Increase spring and fall flow in Paynes Creek (♦). (ERPP Vol. II, Page 248)

Programmatic Action IA: Develop a cooperative approach to increase flow in Paynes Creek by acquiring water from willing sellers or by developing alternative supplies. (ERPP Vol. II, Page 248)

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

Action 1 (High Priority). Supplement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to improve spawning, rearing and migration opportunities for fall-run chinook salmon and steelhead. Involved Parties: Diverters, CDFG, U.S. Bureau of Land Management (BLM), USFWS, USBR, Tehama County Resource Conservation District. (AFRP, Page 50)

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Not included in the guidelines.

Chapter 20. Antelope Creek

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Target 2: Increase flow in Antelope Creek during October 1 through June 30 (♦). (ERPP Vol. II, Page 248)

Programmatic Action 2A: Develop a cooperative approach to evaluate opportunities to increase flow in Antelope Creek. This involves acquiring water from willing sellers or providing alternative water supplies to diverters during the upstream and downstream migration of adult and juvenile spring- and fall-run chinook salmon and steelhead trout. (ERPP Vol. II, Page 248)

Reducing or Eliminating Stressors, Dams and Other Structures

Target 1: Improve chinook salmon and steelhead survival in Antelope Creek by developing a cooperative program to reduce the use of seasonal diversion dams by 50% during the late spring, early fall, and winter (♦♦). (ERPP Vol. II, Page 252)

Programmatic Action 1A: Develop a cooperative program to evaluate the reduced use of seasonal diversion dams that may be barriers to migrating chinook salmon and steelhead in Antelope Creek by acquiring water rights or providing alternative sources of water. (ERPP Vol. II, Page 252)

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

Antelope Creek is an AFRP high priority creek

➔**Action 1 (High Priority).** Supplement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to allow passage of juvenile and adult spring-, fall- and late fall–run chinook salmon and steelhead. Involved Parties: Diverters, CDFG, USFWS, USBR, USFS. (AFRP, Page 50)

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Not included in the guidelines.

Chapter 21. Mill Creek

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Target 3: Increase the flow in Mill Creek (♦).(ERPP Vol. II, Page 248)

Programmatic Action 3A: Develop a cooperative approach to increase flow in the lower 8 miles of Mill Creek. This involves acquiring water from willing sellers or by providing alternative water supplies to diverters during the upstream migration of adult salmon and steelhead. (ERPP Vol. II, Page 248)

ERPP STRATEGIC PLAN, APPENDIX D

Action 2. Acquire water from willing sellers or develop alternative water supplies to provide sufficient instream flows to allow the upstream migration of adult anadromous fish. (Note: this water will be part of the 100 TAF of water purchased to improve stream flows in the Sacramento and San Joaquin Basins. (Strategic Plan, Page D-25)

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

Mill Creek is an AFRP high priority creek.

➔**Action 1 (High Priority).** Continue to provide instream flows in the valley reach of Mill Creek to facilitate the passage of adult and juvenile spring-, fall- and late fall–run chinook salmon and steelhead. Involved Parties: Mill Creek Conservancy, Landowners, CDFG, USFWS, USBR, DWR. (AFRP, Page 52)

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

No flow-related actions listed.

Chapter 22. Deer Creek

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Target 4: Increase flow in the lower 10 miles of Deer Creek (♦).(ERPP Vol. II, Page 248)

Programmatic Action 4A: Develop a cooperative approach to increase flow in the lower section of Deer Creek. This involves innovative means to provide alternative supplies during the upstream migration of adult spring-run and fall-run chinook salmon. (ERPP Vol. II, Page 248–249)

ERPP STRATEGIC PLAN, APPENDIX D

Action 3. Acquire water from willing sellers or develop alternative water supplies to provide sufficient instream flows to allow the upstream migration of adult anadromous fish. (Note: this water will be part of the 100 TAF of water purchased to improve flows in the Sacramento and San Joaquin Basins.) (Strategic Plan, Page D-20)

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

Deer Creek is an AFRP high priority creek.

➔**Action 1 (High Priority).** Acquire water from willing sellers consistent with applicable guidelines or negotiate agreements to supplement instream flows in the lower ten miles of Deer Creek to ensure passage of adult and juvenile spring- and fall-run chinook salmon and steelhead over three diversion dams. Involved Parties: Deer Creek Watershed Conservancy, CDFG, USFWS, USBR. (AFRP, Page 56)

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Not included in the guidelines.

Chapter 23. Feather River

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Target 1: More closely emulate the seasonal streamflow pattern in the Feather River by providing March flow events of 4,000 to 6,000 cfs in dry years, 6,000 to 8,000 cfs in below-normal years, and 8,000 to 10,000 cfs in above-normal years. In addition, evaluating the minimum flows recommended by DFG (1993) will provide a basis to refine the flow needs in the Feather River better. Flow events will be provided only if they are less than or equal to Oroville Reservoir inflow (♦♦). (ERPP Vol. II, Page 271)

Programmatic Action 1 B: Evaluate alternative flow schedules in the Feather River to optimize the ecological benefits for fish and plant communities and ecological processes such as stream meander, sediment transport, and temperature control. (ERPP Vol. II, Page 271)

Target 2: Evaluate the potential benefits to increased natural production of salmon and steelhead in the Feather River of releasing 2,500 cfs from Oroville Dam during September through May and 1,100 cfs during June through August in wet and normal years, and 1,700 cfs during September through May and 800 cfs during June through August in dry years (♦♦). (ERPP Vol. II, Page 271)

Programmatic Action 2A: Develop a cooperative program to supplement Feather River flows with water acquired from new water sources, water transfers, and willing sellers in accordance with applicable guidelines or negotiated agreements. (ERPP Vol. II, Page 271)

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

➔**Action 1 (High Priority).** Supplement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to improve conditions for all life-history stages of fall and spring-run chinook salmon and steelhead. Involved Parties: DWR, CDFG, USFWS, USBR. (AFRP, Page 69)

Action 2 (High Priority). Improve flows for American shad migration, spawning, incubation and rearing from April to June, consistent with actions to protect chinook salmon and steelhead and when hydrologic conditions are adequate to minimize adverse effects to water supply operations. Involved Parties: Diverters, DWR, CDFG, USFWS, USBR. (AFRP, Page 69)

Evaluation 4 (High Priority). Identify and attempt to maintain adequate flows and temperatures for white sturgeon and green sturgeon migration, spawning, incubation and rearing from February to May, consistent with actions to protect chinook salmon and steelhead and when hydrologic conditions are adequate to minimize adverse effects to water supply operations. Involved Parties: CDFG, DWR. (AFRP, Page 71)

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Species and Life History–Stage Priorities

Fall- and spring-run chinook salmon, steelhead, striped bass, American shad, and white and green sturgeon are present in the Feather River. Because spring-run chinook salmon have unknown restoration potential and questionable genetic integrity in the Feather River (CDFG 1996a) and because the CDFG does not note management objectives for steelhead in the Feather River (CDFG 1996b), the AFRP considered fall-run chinook salmon the primary species of concern. Needs for anadromous, non-salmonids are less well known than those for salmonids. The AFRP assumed that the needs for non-salmonids could be partially met by meeting the needs of fall-run chinook salmon. Table 1 prioritizes life-history stages for use in conjunction with the existing standards to generate guidelines for allocation of acquired water in the Feather River.

Table 1. Draft Water Allocation Priorities for Acquired Water on the Feather River

Priority	Life-History Stage	Objective
1	Spawning and incubation (October through December)	Improve attraction flows and provide adequate water temperatures for fall-run chinook salmon migrating into and spawning and incubating in the Feather River.
2	Incubation and Rearing (January through March)	Improve spawning, incubating, and rearing flows and related habitat conditions for fall run chinook salmon, and benefit sturgeon, striped bass, and American shad.
3	Rearing and outmigration (April through May)	Improve rearing and outmigration flows and related habitat conditions and provide adequate temperatures for fall-run chinook salmon in the Feather River; and contribute to improved conditions for survival of fall-run chinook salmon migrating through the lower Sacramento River and the Delta, and benefit other riverine and estuarine species, including other anadromous fish, through contribution to Sacramento River flows and Delta outflows.
4	Over-summering (June through September)	Improve rearing habitat for over-summering juvenile chinook salmon and steelhead.

Recommendations

Minimum flow recommendations for the Feather River were made by CDFG (1993) and the USFWS identified flow needs in the AFRP Working Paper (USFWS 1995).

California Department of Fish and Game: The CDFG (1993) provides recommendations measured at two locations, the riffle one mile below Thermalito Afterbay outlet and Shanghai Bend. Shanghai Bend is downstream of the Yuba River confluence with the Feather River but upstream of the Bear River confluence. For our purposes here, it is assumed that upstream recommendations were to primarily benefit salmonids, and recommendations downstream of the Yuba River were to benefit non-salmonids. In addition to minimum flow recommendations, CDFG recommended water temperatures at both locations. The recommendations consist of a flow schedule for each location.

AFRP Working Paper: The AFRP Working Paper (USFWS 1995) identified flow needs at three locations: the low-flow channel, Gridley, and Nicolaus. Gridley is downstream of Thermalito Afterbay outlet, but relatively close to the riffle one mile downstream of the outlet noted by CDFG (1993). Nicolaus is in the lowest reach of the Feather River downstream of the Bear River confluence. Flows to benefit salmonids are identified for the low-flow channel and at Gridley, needs for white and green sturgeon are identified at Gridley and Nicolaus, and needs for American shad identified at Nicolaus.

For the low-flow channel, the AFRP Working Paper needs are based on an IFIM study conducted by DWR and CDFG. Needs are presented as flows to be used in evaluations (USFWS 1995), because there was uncertainty about the appropriate assumptions pertaining to water-depth preferences of spawning salmonids made in the IFIM study. Therefore, the needs contain two flow schedules, each to evaluate assumptions about water-depth preferences. Schedule B

provides a constant flow of 800 cfs, assuming that salmonids prefer to spawn at a water depth of 1.5 feet. Schedule A provides higher flows (800–1700 cfs and 1,100–2,500 cfs, for critical-dry and below normal–wet water years, respectively), assuming that salmonids prefer to spawn at water depths greater than or equal to 1.5 feet.

Needs for salmonids at Gridley were based on a draft instream flow report by DWR and assumptions that increased flows would improve habitat maintenance (e. g., reduce vegetation encroachment) and water temperature. The AFRP Working Paper proposed that an IFIM study should be completed to evaluate the flows (USFWS 1995). The needs consist of monthly flows for three water-year types.

Flow needs for white and green sturgeon are identified at Gridley and Nicolaus. They were calculated using a year-class index and February through May mean monthly flow at gaging stations in rivers with sturgeon. The year-class index was derived from sturgeon data collected at the SWP salvage facility, and classified as indicating either a good or poor recruitment year. Generally, the lowest mean monthly flow for a good recruitment year was adopted as the flow need for the various gaging stations. Needs apply only to above normal and wet water years.

Flow needs for American shad are presented at Nicolaus, and were calculated using historic Delta inflow from April through June and data from the CDFG midwater trawl for young-of-the-year. Delta inflow for years in which American shad exceeded the AFRP production target (1974 and 1982) was identified. For these years, mean Delta inflow was scaled to mean unimpaired flow and apportioned to rivers in which American shad spawn to produce flow needs. Flow needs are identified for five water-year types. (AFRP Guidelines, Pages 4-5)

Draft Guidelines for Allocation of Acquired Water

The flowing tables contain draft guidelines for allocation of acquired water. Because water acquired from DWR can be released at two locations, upstream and directly downstream of the low-flow channel, and because standards and recommendations apply to several locations and anadromous fish species, the AFRP allocated water primarily at three reaches of the Feather River: the low-flow channel, downstream of Thermalito Afterbay outlet, and Nicolaus.

Table 2 allocates water in the low-flow channel for fall-run chinook salmon. Tables 3 through 5 allocate water directly downstream of Thermalito Afterbay outlet primarily for fall-run chinook salmon and also for sturgeon. A table is developed for using each of the existing standards, flow schedule for less than 55% normal forecasted runoff with a maximum 25% reduction in all months, flow schedule for less than 55% normal forecasted runoff, and flow schedule for 55% normal or greater forecasted runoff. The AFRP made no assumptions concerning flows from the low-flow channel, and considered flow recommendations measured at the riffle one mile downstream of Thermalito Afterbay outlet (CDFG 1993) and at Gridley (USFWS 1995).

Table 6 allocates water primarily at Nicolaus for non-salmonids. However, the table also includes recommendations made for Shanghai Bend (CDFG 1993). The AFRP assumed that flows in tables 3 through 5 would be achieved before allocations in Table 6 would be made. The total volume of water in the Feather River resulting from satisfying recommendations in tables 3 through 5 is 2,713,000 af. Therefore, the volumes of acquired water in Table 6 are in addition to that needed to satisfy tables 3 through 5. The AFRP acknowledges that flows from the Yuba and Bear Rivers would contribute to Feather River flows at Nicolaus, for which existing standards range from 126,000 to 174,000 af for the Yuba River and the existing standard is 10,000 af for the Bear River. However, the USFWS does not account for Yuba and Bear River flows in Table 6. (AFRP Guidelines, Pages 4-6)

Table 2 shows draft guidelines for allocation of acquired water for use in the low-flow channel of the Feather River. The time periods in parentheses in the targeted life history–stage column are approximate time periods when the block of water identified in the block of water column would be allocated for the benefit of the targeted life history–stage. Actual time periods will be based on real-time observations of run-timing, rate of development, and behavior of chinook salmon in the Feather River. The block of water will be managed to maximize benefits to anadromous fish, both in the Feather River and downstream, and in coordination with downstream water managers. (AFRP Guidelines, Page 6)

Table 2. Draft Guidelines for Allocation of Acquired Water for Use in the Low-Flow Channel of the Feather River

Priority	Targeted Life-History Stage	Block of Water (TAF)	Cumulative Total (TAF)	Source
1	Spawning and incubation (October through December)	36	36	AFRP Working Paper (USFWS 1995) minimum releases in low-flow channel schedule B.
2	Rearing and outmigration (April through May)	24	60	AFRP Working Paper (USFWS 1995) minimum releases in low-flow channel schedule B.
3	Incubation and rearing (January through March)	36	96	AFRP Working Paper (USFWS 1995) minimum releases in low-flow channel schedule B.
4	Over-summering (June through September)	48	144	AFRP Working Paper (USFWS 1995) minimum releases in low-flow channel schedule B.
5	Spawning and incubation (October through December)	165	309	AFRP Working Paper (USFWS 1995) minimum releases in low-flow channel schedule A during critical and dry water years.
6	Rearing and outmigration (April through May)	109	418	AFRP Working Paper (USFWS 1995) minimum releases in low-flow channel schedule A during critical and dry water years.
7	Incubation and rearing (January through March)	160	578	AFRP Working Paper (USFWS 1995) minimum releases in low-flow channel schedule A during critical and dry water years.
8	Over-summering (June through September)	54	632	AFRP Working Paper (USFWS 1995) minimum releases in low-flow channel schedule A during critical and dry water years.
9	Spawning and incubation (October through December)	146	778	AFRP Working Paper (USFWS 1995) minimum releases in low-flow channel schedule A during below normal, above normal, and wet water years.

Priority	Targeted Life-History Stage	Block of Water (TAF)	Cumulative Total (TAF)	Source
10	Rearing and outmigration (April through May)	157	935	AFRP Working Paper (USFWS 1995) minimum releases in low-flow channel schedule A during below normal, above normal, and wet water years.
11	Incubation and Rearing (January through March)	143	1078	AFRP Working Paper (USFWS 1995) minimum releases in low-flow channel schedule A during below normal, above normal, and wet water years.
12	Over-summering (June through September)	102	1180	AFRP Working Paper (USFWS 1995) minimum releases in low-flow channel schedule A during below normal, above normal, and wet water years.

Table 3 shows draft guidelines for allocation of acquired water for the Feather River downstream of the outlet of Thermalito Afterbay with an existing standard for less than 55% normal forecasted runoff and 25% reduction in all months. The time periods in parentheses in the targeted life history–stage column are approximate time periods when the block of water identified in the block of water column would be allocated for the benefit of the targeted life-history stage. Actual time periods will be based on real-time observations of run-timing, rate of development, and behavior of chinook salmon in the Feather River. Actual time periods will be based on real-time observations of run-timing, rate of development, and behavior of chinook salmon in the Feather River. The block of water will be managed to maximize benefits to anadromous fish, both in the Feather River and downstream, and in coordination with downstream water managers. Note that allocations are made for sturgeon under priorities 15 and 16.

Table 3. Draft Guidelines for Allocation of Acquired Water for the Feather River Downstream of the Outlet of Thermalito Afterbay with an Existing Standard for Less Than 55% Normal Forecasted Runoff and 25% Reduction in All Months

Priority	Targeted Life-History Stage	Block of Water (TAF)	Cumulative Total (TAF)	Source
1	Spawning and incubation (October through December)	55	55	Existing standard for unimpaired runoff less than 55% of normal and forecasted storage greater than 1,500,000 af.
2	Rearing and outmigration (April through May)	30	85	Existing standard for unimpaired runoff less than 55% of normal and forecasted storage greater than 1,500,000 af.
3	Incubation and Rearing (January through March)	50	135	Existing standard for unimpaired runoff less than 55% of normal and forecasted storage greater than 1,500,000 af.
4	Over-summering (June through September)	60	195	Existing standard for unimpaired runoff less than 55% of normal and forecasted storage greater than 1,500,000 af.
5	Spawning and incubation (October through December)	91	286	Existing standard for unimpaired runoff less than 55% of normal and forecasted storage greater than 1,500,000 af.
6	Incubation and Rearing (January through March)	102	388	Existing standard for unimpaired runoff less than 55% of normal and forecasted storage greater than 1,500,000 af.

Priority	Targeted Life-History Stage	Block of Water (TAF)	Cumulative Total (TAF)	Source
7	Rearing and outmigration (April through May)	133	521	AFRP Working Paper (USFWS 1995) minimum releases for chinook salmon at Gridley during critical and dry water years.
8	Over-summering (June through September)	24	545	AFRP Working Paper (USFWS 1995) minimum releases for chinook salmon at Gridley during critical and dry water years.
9	Rearing and outmigration (April through May)	81	626	CDFG (1993) recommended minimum releases at riffle one mile below outlet of Thermalito Afterbay.
10	Incubation and Rearing (January through March)	54	680	CDFG (1993) recommended minimum releases at riffle one mile below outlet of Thermalito Afterbay.
11	Over-summering (June through September)	65	745	CDFG (1993) recommended minimum releases at riffle one mile below outlet of Thermalito Afterbay.
12	Spawning and incubation (October through December)	146	891	AFRP Working Paper (USFWS 1995) minimum releases for chinook salmon at Gridley during below normal, above normal, and wet water years.
13	Rearing and outmigration (April through May)	28	919	AFRP Working Paper (USFWS 1995) minimum releases for chinook salmon at Gridley during below normal, above normal, and wet water years.
14	Incubation and Rearing (January through March)	89	1008	AFRP Working Paper (USFWS 1995) minimum releases for chinook salmon at Gridley during below normal, above normal, and wet water years.
15	Adult sturgeon migration and spawning (February through March)	526	1534	AFRP Working Paper (USFWS 1995) minimum releases for sturgeon at Gridley during above normal and wet water years.
16	Juvenile sturgeon survival (April through May)	484	2018	AFRP Working Paper (USFWS 1995) minimum releases for sturgeon at Gridley during above normal and wet water years.

Table 4 shows draft guidelines for allocation of acquired water for the Feather River downstream of the outlet of Thermalito Afterbay with an existing standard for less than 55% normal forecasted runoff. The time periods in parentheses in the targeted life history–stage column are approximate time periods when the block of water identified in the block of water column would be allocated for the benefit of the targeted life-history stage. Actual time periods will be based on real-time observations of run-timing, rate of development, and behavior of chinook salmon in the Feather River. Actual time periods will be based on real-time observations of run-timing, rate of development, and behavior of chinook salmon in the Feather River. The block of water will be managed to maximize benefits to anadromous fish, both in the Feather River and downstream, and in coordination with downstream water managers. Note that allocations are made for sturgeon under priorities 11 and 12.

Table 4. Draft Guidelines for Allocation of Acquired Water for the Feather River Downstream of the Outlet of Thermalito Afterbay with an Existing Standard for Less Than 55% Normal Forecasted Runoff

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
1	Spawning and incubation (October through December)	91	91	Existing standard for unimpaired runoff greater than 55% of normal and forecasted storage greater than 1,500,000 af.
2	Incubation and rearing (January through March)	102	193	Existing standard for unimpaired runoff greater than 55% of normal and forecasted storage greater than 1,500,000 af.
3	Rearing and outmigration (April through May)	133	326	AFRP Working Paper (USFWS 1995) minimum releases for chinook salmon at Gridley during critical and dry water years.
4	Over-summering (June through September)	24	350	AFRP Working Paper (USFWS 1995) minimum releases for chinook salmon at Gridley during critical and dry water years.
5	Rearing and outmigration (April through May)	81	431	CDFG (1993) recommended minimum releases at riffle one mile below outlet of Thermalito Afterbay.
6	Incubation and rearing (January through March)	54	485	CDFG (1993) recommended minimum releases at riffle one mile below outlet of Thermalito Afterbay.
7	Over-summering (June through September)	65	550	CDFG (1993) recommended minimum releases at riffle one mile below outlet of Thermalito Afterbay.
8	Spawning and incubation (October through December)	146	696	AFRP Working Paper (USFWS 1995) minimum releases for chinook salmon at Gridley during below normal, above normal, and wet water years.
9	Rearing and outmigration (April through May)	28	724	AFRP Working Paper (USFWS 1995) minimum releases for chinook salmon at Gridley during below normal, above normal, and wet water years.
10	Incubation and rearing (January through March)	89	813	AFRP Working Paper (USFWS 1995) minimum releases for chinook salmon at Gridley during below normal, above normal, and wet water years.
11	Adult sturgeon migration and spawning (February through March)	526	1339	AFRP Working Paper (USFWS 1995) minimum releases for sturgeon at Gridley during above normal and wet water years.
12	Juvenile sturgeon survival (April through May)	484	1823	AFRP Working Paper (USFWS 1995) minimum releases for sturgeon at Gridley during above normal and wet water years.

Table 5 shows draft guidelines for allocation of acquired water for the Feather River downstream of the outlet of Thermalito Afterbay with an existing standard of 55% normal or greater forecasted runoff. The time periods in parentheses in the targeted life history–stage column are approximate time periods when the block of water identified in the block of water column would be allocated for the benefit of the targeted life history–stage. Actual time periods will be based on real-time observations of run-timing, rate of development, and behavior of chinook salmon in the Feather River. Actual time periods will be based on real-time observations

of run-timing, rate of development, and behavior of chinook salmon in the Feather River. The block of water will be managed to maximize benefits to anadromous fish, both in the Feather River and downstream, and in coordination with downstream water managers. Note that allocations are made for sturgeon under priorities 9 and 10.

Table 5. Draft guidelines for Allocation of Acquired Water for the Feather River Downstream of the Outlet of Thermalito Afterbay with an Existing Standard of 55% Normal or Greater Forecasted Runoff

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
1	Rearing and outmigration (April through May)	133	133	AFRP Working Paper (USFWS 1995) minimum releases for chinook salmon at Gridley during critical and dry water years.
2	Over-summering (June through September)	24	157	AFRP Working Paper (USFWS 1995) minimum releases for chinook salmon at Gridley during critical and dry water years.
3	Rearing and outmigration (April through May)	81	238	CDFG (1993) recommended minimum releases at riffle one mile below outlet of Thermalito Afterbay.
4	Incubation and rearing (January through March)	54	292	CDFG (1993) recommended minimum releases at riffle one mile below outlet of Thermalito Afterbay.
5	Over-summering (June through September)	65	357	CDFG (1993) recommended minimum releases at riffle one mile below outlet of Thermalito Afterbay.
6	Spawning and incubation (October through December)	146	503	AFRP Working Paper (USFWS 1995) minimum releases for chinook salmon at Gridley during below normal, above normal, and wet water years.
7	Rearing and outmigration (April through May)	28	531	AFRP Working Paper (USFWS 1995) minimum releases for chinook salmon at Gridley during below normal, above normal, and wet water years.
8	Incubation and rearing (January through March)	89	620	AFRP Working Paper (USFWS 1995) minimum releases for chinook salmon at Gridley during below normal, above normal, and wet water years.
9	Adult sturgeon migration and spawning (February through March)	526	1146	AFRP Working Paper (USFWS 1995) minimum releases for sturgeon at Gridley during above normal and wet water years.
10	Juvenile sturgeon survival (April through May)	484	1630	AFRP Working Paper (USFWS 1995) minimum releases for sturgeon at Gridley during above normal and wet water years.

Table 6 shows draft guidelines for allocation of acquired water for the Feather River at Shanghai Bend and Nicolaus, assuming that allocations in tables 3 through 5 have been satisfied. The time periods in parentheses in the targeted life history–stage column are approximate time periods when the block of water identified in the block of water column would be allocated for the benefit of the targeted life-history stage. Actual time periods will be based on real-time observations of run-timing, rate of development, and behavior of chinook salmon in the Feather River. Actual time periods will be based on real-time observations of run-timing, rate of

development, and behavior of chinook salmon in the Feather River. The block of water will be managed to maximize benefits to anadromous fish, both in the Feather River and downstream, and in coordination with downstream water managers.

Table 6. Draft Guidelines for Allocation of Acquired Water for the Feather River at Shanghai Bend and Nicolaus*

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
1	Early adult migration (January)	12	12	CDFG (1993) recommended minimum releases at Shanghai Bend to benefit non-salmonids.
2	Juvenile survival (July through August)	159	171	CDFG (1993) recommended minimum releases at Shanghai Bend to benefit non-salmonids.
3	Adult migration and spawning (February through March)	527	698	AFRP Working Paper (USFWS 1995) minimum releases for sturgeon at Nicolaus during above normal and wet water years.
4	Juvenile survival (April through May)	544	1242	AFRP Working Paper (USFWS 1995) minimum releases for sturgeon at Nicolaus during above normal and wet water years.
5	Survival of eggs and larvae (June)	8	1250	AFRP Working Paper (USFWS 1995) minimum releases for American shad at Nicolaus during below normal water years.
6	Adult attraction and spawning (April through May)	29	1279	AFRP Working Paper (USFWS 1995) minimum releases for American shad at Nicolaus during above normal water years.
7	Survival of eggs and larvae (June)	47	1326	AFRP Working Paper (USFWS 1995) minimum releases for American shad at Nicolaus during above normal water years.
8	Adult attraction and spawning (April through May)	673	1999	AFRP Working Paper (USFWS 1995) minimum releases for American shad at Nicolaus during wet water years.
9	Survival of eggs and larvae (June)	304	2303	AFRP Working Paper (USFWS 1995) minimum releases for American shad at Nicolaus during wet water years.

*Assumes that allocations in Feather River Tables 3–5 have been satisfied.

Chapter 24. Yuba River

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Target 3: Supplement flows in the Yuba River with March flow events of 2,000 to 3,000 cfs in dry years and 3,000 to 4,000 cfs in normal years to improve conditions for all chinook salmon, steelhead, and American shad life stages. In addition, provide minimum flows recommended at Marysville by CDFG (1993). See table below; flows will be provided only if inflow to Englebright and New Bullards Bar Reservoirs is sufficient to meet the flow requirements (♦♦). (ERPP Vol. II, Page 271)

Minimum Streamflow Recommendations for Yuba River at Marysville

Period	Flow in All Water-YearTypes
October l–March 31	600–700 cfs
April 1–June 30	1,000 cfs minimum
July l–September 10	450 cfs

Programmatic Action 3A: Supplement flows in the Yuba River below Englebright Dam with water acquired from new water sources, water transfers, and willing sellers, consistent with applicable guidelines or negotiated agreements to provide flows recommended by CDFG (1993) to improve conditions for all chinook salmon and steelhead life stages. See table above. (ERPP Vol. II, Page 272)

Reducing or Eliminating Stressors, Dams and Other Structures

Target 1: Increase adult and juvenile anadromous fish Passage in the Yuba River by providing access to 100% of the available habitat below Englebright Dam (♦♦♦). (ERPP Vol. II, Page 278)

Programmatic Action lA: Develop a cooperative program to improve anadromous fish passage in the Yuba River by removing dams or constructing fish ladders, providing passage flows, keeping channels open, eliminating predator habitat at instream structures, and constructing improved fish bypasses at diversions. (ERPP Vol. II, Page 278)

Programmatic Action 1B: Facilitate passage of spawning adult salmonids in the Yuba River by maintaining appropriate flows through the fish ladders or modifying the fish ladders at diversion dams. (ERPP Vol. II, Page 278)

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

➔**Action 1 (High Priority).** Supplement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to improve conditions for all life-history stages of chinook salmon and steelhead. Involved Parties: Yuba County Water Agency (YCWA), SWRCB, CDFG, USFWS, USBR. (AFRP, Page 71)

Action 2 (High Priority). Improve flows for American shad migration, spawning, incubation and rearing from April to June, consistent with actions to protect chinook salmon and steelhead and when hydrologic conditions are adequate to minimize adverse effects to water supply operations. Involved Parties: YCWA, SWRCB, CDFG, USFWS, USBR. (AFRP, Page 71)

Action 3 (High Priority). Reduce and control flow fluctuations to avoid and minimize adverse effects to juvenile salmonids. Involved Parties: YCWA, PG&E, SWRCB, CDFG. (AFRP, Page 72)

Action 4 (High Priority). Maintain adequate instream flows for temperature control. Involved Parties: YCWA, CDFG, USFWS, USBR. (AFRP, Page 72)

Evaluation 1 (High Priority). Evaluate the effectiveness of pulse flows to facilitate successful juvenile salmonid emigration. Involved Parties: YCWA, CDFG, USFWS, USBR. (AFRP, Page 73)

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Species and Life History–Stage Priorities

Table 1 shows draft water allocation priorities for (b)(3) water on the Yuba River. The time periods in parentheses in the life history–stage column are approximate time periods when that life-history stage is present in the river. Actual time periods vary dependent on run-timing, environmental conditions, and rate of development.

Table 1. Draft Allocation Priorities for (b)(3) Water on the Yuba River

Priority	Life-history stage	Objective
1	Spawning and incubation (October through December)	Improve attraction flows and water temperatures for fall-run chinook salmon and steelhead migrating into and spawning and incubating in the Yuba River.
3	Incubation and rearing (January through March)	Improve spawning, incubating, and rearing flows and related habitat conditions for fall-run chinook salmon and steelhead, and benefit sturgeon, striped bass, and other species through contribution to Sacramento River flows and Delta outflows.
2	Rearing and outmigration (April through May)	Improve rearing and outmigration flows and related habitat conditions and provide adequate temperatures for fall-run chinook salmon in the Yuba River; and contribute to improved migration and spawning conditions for American shad. Also, contribute to improved conditions for survival of Sacramento basin fall-run chinook salmon migrating through the Sacramento River and the Delta, and benefit other riverine and estuarine species, including other anadromous fish, through contribution to Sacramento River flows and Delta outflows.
4	Over-summering (June through September)	Improve rearing habitat for over-summering juvenile chinook salmon and steelhead.

Recommendations

Yuba County Water Agency: The YCWA alternative for minimum flows, specified for the Marysville gage, uses stage and discharge and WUA relationships, based on fisheries studies conducted by Beak Consultants from 1986 to 1988, a water temperature model developed by Bookman–Edmunston Engineering, Inc. (1992), and operational constraints to maximize available water by year type for fall-run chinook salmon and steelhead life history requirements. Salmon life stage requirements are prioritized by two time periods, first is spawning and incubation (October 15 through March 31), and second is rearing and out-migration (April through June). The YCWA recommends minimum instream flows at Marysville for six water-year types in the draft report. They define water-year type using an index derived from the comparison of estimated annual and historical (1922 to 1992) unimpaired runoff at the Smartville gage. The annual 60: 40 index is a weighted average of the percent of annual runoff to average historical runoff in the snowmelt period, April through July, weighted 60%; averaged

with the percent of annual runoff to historical runoff for the entire year, weighted 40%. Using this index, two water-year allocations account for "normal and above" conditions and four water-year allocations are specified for below normal water years. Allocation within a water year first looks to achieve water temperature targets set at Marysville, and secondarily at Daguerre Point Dam from June through October 14 if the Marysville temperature criteria cannot be met. Secondly, an attempt to maximize physical habitat (90% of the maximum WUA value) for a given salmon life-history stage, within the range of flows that could meet the water temperature targets was determined using a stepwise iterative process.

California Dept of Fish and Game: In their Lower Yuba River Fisheries Management Plan (CDFG 1991), the CDFG recommended instream flows at Marysville for normal and wetter water years. Similar to the YCWA recommendation, CDFG's minimum flow recommendation targets specific benefits for fall-run chinook salmon and steelhead and secondarily for American shad, recognizing that there is little conflict between the needs for shad and salmon and steelhead. The CDFG based their water year type designations on a comparison of the estimated unimpaired runoff at the Smartville gage for the current year, as reported in the May 1 Report of Water Conditions in California by the DWR. For below normal water years CDFG states that reductions to the recommended fishery flows shall be made, but does not specify how water would be allocated for fish in these water-year types, other than equitable reductions to for all users. CDFG's minimum flow recommendations derive from integrating information from a three-year study that included basic fisheries investigations; IFIM, to determine salmon life-stage physical habitat requirements; and temperature modeling, coupled with Pacific coast anadromous fish temperature requirements. CDFG's recommendation hinges on balancing physical habitat requirements (WUA and streamflow indices) for overlapping life-history stages with other concurrent fish needs such as maintenance of flows to prevent redd de-watering, juvenile standing, and juvenile out-migration.

Federal Energy Regulatory Commission staff: FERC staff recommended minimum instream flows in their 1992 NEPA Environmental Assessment (EA) for the Narrows Project. Although FERC specified that these minimum fisheries flows were to be met below Englebright Reservoir, the AFRP generated a Marysville flow equivalent using a conversion factor generated from averaged mean monthly flows for a range of percent exceedence levels (0%, 10%, 50%, 90% and 100%) from both locations. This conversion is based on conditions that existed from 1970 to 1990, and may differ from future conditions if project operations change. Their recommendation started with the maximum and minimum flow boundaries proposed in CDFG's 1991 recommendation, the release capacity of the Narrows Project, and CDFG's WUA curves by life stage to produce a flow schedule that they felt would enhance the fishery relative to existing conditions. The recommendation is for all water-year types and considers all three anadromous species in the system.

AFRP Working Paper: The AFRP Working Paper recommends two sets of minimum instream flows, one set for salmon and steelhead and another for shad. The shad recommendation allocates water in addition to salmon flows during the April through May period for shad attraction, migration and spawning. The shad recommendation is divided into five water-year types of wet, above-normal, below-normal, dry, and critical; the salmon recommendation serves all water-year types. Water-year types for salmon and shad recommendations are based on the

Sacramento River Index used in the SWRCB Draft Water Right Decision 1630. Flows for October through January are based on the water-year type for the previous year. (AFRP Guidelines, Pages 17-19)

Draft Guidelines for Allocation of Acquired Water

Tables 2 through 5 show guidelines for allocation of water acquired pursuant to Section 3406(b)(3) of the CVPIA for use on the Yuba River for differing types of water years .

Table 2. Draft Guidelines for Allocation of Acquired Water for Use on the Yuba River for Water Years Less Than 40% of Normal

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Support
1	Spawning and incubation (October through December)	7	7	1965 standard for minimum instream flows below Daguerre Point Dam for a 41% to 45% of normal water year, agreement between the California Department of Fish and Game and the Yuba County Water Agency (YCWA).
2	Rearing and outmigration (April through May)	3	10	1965 standard for minimum instream flows below Daguerre Point Dam for a 41% to 45% of normal water year.
3	Incubation and rearing (January through March)	4	14	1965 standard for minimum instream flows below Daguerre Point Dam for a 41% to 45% of normal water year.
4	Over-summering (June through September)	1	15	1965 standard for minimum instream flows below Daguerre Point Dam for a 41% to 45% of normal water year.
5	Spawning and incubation (October through December)	4	19	1965 standard for minimum instream flows below Daguerre Point Dam for a 46% to 50% of normal water year.
6	Rearing and outmigration (April through May)	1	20	1965 standard for minimum instream flows below Daguerre Point Dam for a 46% to 50% of normal water year.
7	Incubation and rearing (January through March)	2	22	1965 standard for minimum instream flows below Daguerre Point Dam for a 46% to 50% of normal water year.
8	Over-summering (June through September)	1	23	1965 standard for minimum instream flows below Daguerre Point Dam for a 46% to 50% of normal water year.
9	Spawning and incubation (October through December)	11	34	1965 standard for minimum instream flows below Daguerre Point Dam for normal and wetter water-year types.
10	Rearing and outmigration (April through May)	4	38	1965 standard for minimum instream flows below Daguerre Point Dam for normal and wetter water-year types.
11	Incubation and rearing (January through March)	7	45	1965 standard for minimum instream flows below Daguerre Point Dam for normal and wetter water-year types.

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Support
12	Over-summering (June through September)	2	47	1965 standard for minimum instream flows below Daguerre Point Dam for normal and wetter water-year types.
13	Rearing and outmigration (April through May)	19	66	YCWA's 1996 recommended lower Yuba River minimum instream flow at Marysville for a below-normal water year, (as cited in the Anadromous Fish Enhancement Actions Recommended for the Lower Yuba River, prepared by Beak Consultants, Incorporated, 1996).
14	Incubation and rearing (January through March)	28	94	YCWA's 1996 recommended minimum instream flow for extra critical water years.
15	Over-summering (June through September)	12	106	YCWA's 1996 recommended minimum instream flow for extra critical and critical water years.
16	Spawning and incubation (October through December)	5	111	Federal Energy Regulatory Commission (FERC), 1992 staff recommendation for minimum instream flow for all water year types, Environmental Assessment (EA) for Hydropower License, Narrows Project, FERC Project Number 1403-004, California.
17	Rearing and outmigration (April through May)	14	125	FERC, 1992 staff recommendation for minimum instream flow for all water year types.
18	Incubation and rearing (January through March)	9	134	FERC, 1992 staff recommendation for minimum instream flow for all water year types.
19	Over-summering (June through September)	3	137	YCWA's 1996 recommended minimum instream flow for below-normal water years.
20	Spawning and incubation (October through December)	13	150	YCWA's 1996 recommended minimum instream flow for normal water years.
21	Rearing and outmigration (April through June)	56	206	YCWA's 1996 recommended minimum instream flow for normal water years.
22	Incubation and rearing (January through March)	9	215	YCWA's 1996 recommended minimum instream flow for normal water years.
23	Over-summering (June through September)	56	271	FERC, 1992 staff recommendation for minimum instream flow for all water year types.
24	Spawning and incubation (October through December)	30	301	CDFG minimum instream flow recommendation for normal and above water years, Lower Yuba River Fisheries Management Plan, 1991.
25	Rearing and outmigration (April through June)	64	365	CDFG minimum instream flow recommendation for normal and above water years, Lower Yuba River Fisheries Management Plan, 1991.
26	Incubation and rearing (January through March)	36	401	CDFG minimum instream flow recommendation for normal and above water years, Lower Yuba River Fisheries Management Plan, 1991.

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Support
27	Over-summering (July through September)	45	446	YCWA's 1996 recommended minimum instream flow in a normal water year.
28	Spawning and incubation (October through December)	7	453	AFRP Working Paper (USFWS 1995) minimum releases in a critical water year, without releases targeted specifically for American shad.
29	Rearing and outmigration (April through June)	120	573	AFRP Working Paper (USFWS 1995) minimum releases in a critical water year, including releases targeted specifically for American shad.
30	Over-summering (July through September)	28	601	CDFG minimum instream flow recommendation for normal and above water years, Lower Yuba River Fisheries Management Plan, 1991.
31	Rearing and outmigration (April through June)	218	819	AFRP Working Paper (USFWS 1995) minimum releases in a dry water year, including releases targeted specifically for American shad.
32	Over-summering (July through September)	228	1047	YCWA's 1996 recommended minimum instream flow in a wet water year.
33	Rearing and outmigration (April through June)	218	1265	AFRP Working Paper (USFWS 1995) minimum releases in a below-normal water year, including releases targeted specifically for American shad.
34	Rearing and outmigration (April through June)	109	1374	AFRP Working Paper (USFWS 1995) minimum releases in an above-normal water year, including releases targeted specifically for American shad.
35	Rearing and outmigration (April through June)	266	1640	AFRP Working Paper (USFWS 1995) minimum releases in a wet water year, including releases targeted specifically for American shad.

Table 3. Guidelines for Allocation of Acquired Water for Use on the Yuba River for Water Years 41% to 45% of Normal

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Support
1	Spawning and incubation (October through December)	4	4	1965 standard for minimum instream flows below Daguerre Point Dam for a 46% to 50% of normal water year, agreement between the California Department of Fish and Game and the Yuba County Water Agency (YCWA).
2	Rearing and outmigration (April through May)	1	5	1965 standard for minimum instream flows below Daguerre Point Dam for a 46% to 50% of normal water year.
3	Incubation and rearing (January through March)	2	7	1965 standard for minimum instream flows below Daguerre Point Dam for a 46% to 50% of normal water year.
4	Over-summering (June through September)	1	8	1965 standard for minimum instream flows below Daguerre Point Dam for a 46% to 50% of normal water year.
5	Spawning and incubation (October through December)	11	19	1965 standard for minimum instream flows below Daguerre Point Dam for normal and wetter water-year types.

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Support
6	Rearing and outmigration (April through May)	4	23	1965 standard for minimum instream flows below Daguerre Point Dam for normal and wetter water-year types.
7	Incubation and rearing (January through March)	7	30	1965 standard for minimum instream flows below Daguerre Point Dam for normal and wetter water-year types.
8	Over-summering (June through September)	2	32	1965 standard for minimum instream flows below Daguerre Point Dam for normal and wetter water-year types.
9	Rearing and outmigration (April through May)	19	51	YCWA's 1996 recommended lower Yuba River minimum instream flow at Marysville for a below-normal water year, (as cited in the Anadromous Fish Enhancement Actions Recommended for the Lower Yuba River, prepared by Beak Consultants, Incorporated, 1996).
10	Incubation and rearing (January through March)	28	79	YCWA's 1996 recommended minimum instream flow for extra critical water years.
11	Over-summering (June through September)	12	91	YCWA's 1996 recommended minimum instream flow for extra critical and critical water years.
12	Spawning and incubation (October through December)	5	96	Federal Energy Regulatory Commission (FERC), 1992 staff recommendation for minimum instream flow for all water year types, Environmental Assessment (EA) for Hydropower License, Narrows Project, FERC Project Number 1403-004, California.
13	Rearing and outmigration (April through May)	14	110	FERC, 1992 staff recommendation for minimum instream flow for all water year types.
14	Incubation and rearing (January through March)	9	119	FERC, 1992 staff recommendation for minimum instream flow for all water year types.
15	Over-summering (June through September)	3	122	YCWA's 1996 recommended minimum instream flow for below-normal water years.
16	Spawning and incubation (October through December)	13	135	YCWA's 1996 recommended minimum instream flow for normal water years.
17	Rearing and outmigration (April through June)	56	191	YCWA's 1996 recommended minimum instream flow for normal water years.
18	Incubation and rearing (January through March)	9	200	YCWA's 1996 recommended minimum instream flow for normal water years.
19	Over-summering (June through September)	56	256	FERC, 1992 staff recommendation for minimum instream flow for all water year types.
20	Spawning and incubation (October through December)	30	286	CDFG minimum instream flow recommendation for normal and above water years, Lower Yuba River Fisheries Management Plan, 1991.

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Support
21	Rearing and outmigration (April through June)	64	350	CDFG minimum instream flow recommendation for normal and above water years, Lower Yuba River Fisheries Management Plan, 1991.
22	Incubation and rearing (January through March)	36	386	CDFG minimum instream flow recommendation for normal and above water years, Lower Yuba River Fisheries Management Plan, 1991.
23	Over-summering (July through September)	45	431	YCWA's 1996 recommended minimum instream flow in a normal water year.
24	Spawning and incubation (October through December)	7	438	AFRP Working Paper (USFWS 1995) minimum releases in a critical water year, without releases targeted specifically for American shad.
25	Rearing and outmigration (April through June)	120	558	AFRP Working Paper (USFWS 1995) minimum releases in a critical water year, including releases targeted specifically for American shad.
26	Over-summering (July through September)	28	586	CDFG minimum instream flow recommendation for normal and above water years, Lower Yuba River Fisheries Management Plan, 1991.
27	Rearing and outmigration (April through June)	218	804	AFRP Working Paper (USFWS 1995) minimum releases in a dry water year, including releases targeted specifically for American shad.
28	Over-summering (July through September)	228	1032	YCWA's 1996 recommended minimum instream flow in a wet water year.
29	Rearing and outmigration (April through June)	218	1250	AFRP Working Paper (USFWS 1995) minimum releases in a below-normal water year, including releases targeted specifically for American shad.
30	Rearing and outmigration (April through June)	109	1359	AFRP Working Paper (USFWS 1995) minimum releases in an above-normal water year, including releases targeted specifically for American shad.
31	Rearing and outmigration (April through June)	266	1625	AFRP Working Paper (USFWS 1995) minimum releases in a wet water year, including releases targeted specifically for American shad.

Table 4. Guidelines for Allocation of Acquired Water for Use on the Yuba River for Water Years 46% to 50% of Normal

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Support
1	Spawning and incubation (October through December)	11	11	1965 standard for minimum instream flows below Daguerre Point Dam for normal and wetter water-year types, agreement between the California Department of Fish and Game and the Yuba County Water Agency (YCWA).
2	Rearing and outmigration (April through May)	4	15	1965 standard for minimum instream flows below Daguerre Point Dam for normal and wetter water-year types.
3	Incubation and rearing (January through March)	7	22	1965 standard for minimum instream flows below Daguerre Point Dam for normal and wetter water-year types.

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Support
4	Over-summering (June through September)	2	24	1965 standard for minimum instream flows below Daguerre Point Dam for normal and wetter water-year types.
5	Rearing and outmigration (April through May)	19	43	YCWA's 1996 recommended lower Yuba River minimum instream flow at Marysville for a below-normal water year, (as cited in the Anadromous Fish Enhancement Actions Recommended for the Lower Yuba River, prepared by Beak Consultants, Incorporated, 1996).
6	Incubation and rearing (January through March)	28	71	YCWA's 1996 recommended minimum instream flow for extra critical water years.
7	Over-summering (June through September)	12	83	YCWA's 1996 recommended minimum instream flow for extra critical and critical water years.
8	Spawning and incubation (October through December)	5	88	Federal Energy Regulatory Commission (FERC), 1992 staff recommendation for minimum instream flow for all water year types, Environmental Assessment (EA) for Hydropower License, Narrows Project, FERC Project Number 1403-004, California.
9	Rearing and outmigration (April through May)	14	102	FERC, 1992 staff recommendation for minimum instream flow for all water year types, EA for Hydropower License.
10	Incubation and rearing (January through March)	9	111	FERC, 1992 staff recommendation for minimum instream flow for all water year types, EA for Hydropower License.
11	Over-summering (June through September)	3	114	YCWA's 1996 recommended minimum instream flow for below-normal water years.
12	Spawning and incubation (October through December)	13	127	YCWA's 1996 recommended minimum instream flow for normal water years.
13	Rearing and outmigration (April through June)	56	183	YCWA's 1996 recommended minimum instream flow for normal water years.
14	Incubation and rearing (January through March)	9	192	YCWA's 1996 recommended minimum instream flow for normal water years.
15	Over-summering (June through September)	56	248	FERC, 1992 staff recommendation for minimum instream flow for all water year types, EA for Hydropower License.
16	Spawning and incubation (October through December)	30	278	CDFG minimum instream flow recommendation for normal and above water years, Lower Yuba River Fisheries Management Plan, 1991.
17	Rearing and outmigration (April through June)	64	342	CDFG minimum instream flow recommendation for normal and above water years, Lower Yuba River Fisheries Management Plan, 1991.
18	Incubation and rearing (January through March)	36	378	CDFG minimum instream flow recommendation for normal and above water years, Lower Yuba River Fisheries Management Plan, 1991.

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Support
19	Over-summering (July through September)	45	423	YCWA's 1996 recommended minimum instream flow in a normal water year.
20	Spawning and incubation (October through December)	7	430	AFRP Working Paper (USFWS 1995) minimum releases in a critical water year, without releases targeted specifically for American shad.
21	Rearing and outmigration (April through June)	120	550	AFRP Working Paper (USFWS 1995) minimum releases in a critical water year, including releases targeted specifically for American shad.
22	Over-summering (July through September)	28	578	CDFG minimum instream flow recommendation for normal and above water years, Lower Yuba River Fisheries Management Plan, 1991.
23	Rearing and outmigration (April through June)	218	796	AFRP Working Paper (USFWS 1995) minimum releases in a dry water year, including releases targeted specifically for American shad.
24	Over-summering (July through September)	228	1024	YCWA's 1996 recommended minimum instream flow in a wet water year.
25	Rearing and outmigration (April through June)	218	1242	AFRP Working Paper (USFWS 1995) minimum releases in a below-normal water year, including releases targeted specifically for American shad.
26	Rearing and outmigration (April through June)	109	1351	AFRP Working Paper (USFWS 1995) minimum releases in an above-normal water year, including releases targeted specifically for American shad.
27	Rearing and outmigration (April through June)	266	1617	AFRP Working Paper (USFWS 1995) minimum releases in a wet water year, including releases targeted specifically for American shad.

Table 5. Guidelines for Allocation of Acquired Water for Use on the Yuba River for Normal and Wetter Water years

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Support
1	Rearing and outmigration (April through May)	19	19	YCWA's 1996 recommended lower Yuba River minimum instream flow at Marysville for a below-normal water year, (as cited in the Anadromous Fish Enhancement Actions Recommended for the Lower Yuba River, prepared by Beak Consultants, Incorporated, 1996).
2	Incubation and rearing (January through March)	28	47	YCWA's 1996 recommended minimum instream flow for extra critical water years.
3	Over-summering (June through September)	12	59	YCWA's 1996 recommended minimum instream flow for extra critical and critical water years.
4	Spawning and incubation (October through December)	5	64	Federal Energy Regulatory Commission (FERC), 1992 staff recommendation for minimum instream flow for all water year types.

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Support
5	Rearing and outmigration (April through May)	14	78	Federal Energy Regulatory Commission (FERC), 1992 staff recommendation for minimum instream flow for all water year types.
6	Incubation and rearing (January through March)	9	87	Federal Energy Regulatory Commission (FERC), 1992 staff recommendation for minimum instream flow for all water year types.
7	Over-summering (June through September)	3	90	YCWA's 1996 recommended minimum instream flow for below-normal water years.
8	Spawning and incubation (October through December)	13	103	YCWA's 1996 recommended minimum instream flow for normal water years.
9	Rearing and outmigration (April through June)	56	159	YCWA's 1996 recommended minimum instream flow for normal water years.
10	Incubation and rearing (January through March)	9	168	YCWA's 1996 recommended minimum instream flow for normal water years.
11	Over-summering (June through September)	56	224	Federal Energy Regulatory Commission (FERC), 1992 staff recommendation for minimum instream flow for all water year types.
12	Spawning and incubation (October through December)	30	254	CDFG minimum instream flow recommendation for normal and above water years, Lower Yuba River Fisheries Management Plan, 1991.
13	Rearing and outmigration (April through June)	64	318	CDFG minimum instream flow recommendation for normal and above water years, Lower Yuba River Fisheries Management Plan, 1991.
14	Incubation and rearing (January through March)	36	354	CDFG minimum instream flow recommendation for normal and above water years, Lower Yuba River Fisheries Management Plan, 1991.
15	Over-summering (July through September)	45	399	YCWA's 1996 recommended minimum instream flow in a normal water year.
16	Spawning and incubation (October through December)	7	406	AFRP Working Paper (USFWS 1995) minimum releases in a critical water year, without releases targeted specifically for American shad.
17	Rearing and outmigration (April through June)	120	526	AFRP Working Paper (USFWS 1995) minimum releases in a critical water year, including releases targeted specifically for American shad.
18	Over-summering (July through September)	28	554	CDFG minimum instream flow recommendation for normal and above water years, Lower Yuba River Fisheries Management Plan, 1991.
19	Rearing and outmigration (April through June)	218	772	AFRP Working Paper (USFWS 1995) minimum releases in a dry water year, including releases targeted specifically for American shad.
20	Over-summering (July through September)	228	1000	YCWA's 1996 recommended minimum instream flow in a wet water year.
21	Rearing and outmigration (April through June)	218	1218	AFRP Working Paper (USFWS 1995) minimum releases in a below-normal water year, including releases targeted specifically for American shad.

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Support
22	Rearing and outmigration (April through June)	109	1327	AFRP Working Paper (USFWS 1995) minimum releases in an above-normal water year, including releases targeted specifically for American shad.
23	Rearing and outmigration (April through June)	266	1593	AFRP Working Paper (USFWS 1995) minimum releases in a wet water year, including releases targeted specifically for American shad.

Chapter 25. Bear River

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Target 4: Supplement flows in the Bear River to improve conditions for all chinook salmon and steelhead life stages. Provide a flow event of 300 to 500 cfs in dry years. See table below for recommended minimum streamflows (♦ ♦).(ERPP Vol. II, Page 272)

Minimum Streamflow Recommendations for Bear River

Month	Flows (cfs)
October 1–14	100
October 15–December 15	250
January–March	250
April–June	250
July–September	10

Programmatic Action 4A: Supplement flows in the Bear River with water acquired from new water sources, water transfers, and willing sellers consistent with applicable guidelines or negotiated agreements to provide flows that will improve conditions for all chinook salmon and steelhead life stages. (ERPP Vol. II, Page 272)

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

Action 1 (High Priority). Supplement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements to improve conditions for all life-

history stages of chinook salmon and steelhead. Involved Parties: South Sutter Water District (SSWD), SWRCB, CDFG, USFWS, USBR. (AFRP, Page 74)

Evaluation 1 (High Priority). Determine and evaluate instream flow requirements that ensure adequate flows for all life stages of all salmonids. Involved Parties: SSWD, CDFG, USFWS, USBR. (AFRP, Page 74)

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Species and Life History–Stage Priorities

On the Bear River, species considered include fall-run chinook salmon, steelhead and sturgeon. Priorities are specified primarily for chinook salmon, but steelhead should coincidentally benefit from the flow schedule prioritized for fall-run chinook salmon. Sturgeon are ranked secondarily to the salmonids as they are known to use the lower Bear River, but only sporadically and generally in wet years. Enough information on Bear River sturgeon exists to warrant specific allocation of water to benefit the species given that acquisition of water is feasible. Table 1 prioritizes salmon life-history stages for use in conjunction with the existing standards to generate guidelines for allocating acquired water in the Bear River. Sturgeon life-history priorities are not presented here per se. In the Working Paper, 650 cubic feet per second (cfs) of water is additionally allocated to that recommended for salmon from February through May. Thus, given that enough water can be acquired, allocation of water to improve sturgeon production would follow priorities two and three for salmon in the table below. This would encompass the allocation of water from February through May and would be implemented chronologically.

Table 1 shows draft water allocation priorities for (b)(3) water on the Bear River. The time periods in parentheses in the life history–stage column are approximate time periods when that life-history stage is present in the river. Actual time periods vary, dependent on run-timing, environmental conditions, and rate of development.

Table 1. Draft Water Allocation Priorities for (b)(3) Water on the Bear River

Priority	Life-history stage	Objective
1	Spawning and incubation (October through December)	Improve attraction flows and water temperatures for fall-run chinook salmon and steelhead migrating into and spawning and incubating in the Bear River.
3	Incubation and rearing (January through March)	Improve spawning, incubating, and rearing flows and related habitat conditions for fall-run chinook salmon and steelhead, and benefit sturgeon, striped bass, and other species through contribution to Sacramento River flows and Delta outflows.

Priority	Life-history stage	Objective
2	Rearing and outmigration (April through May)	Improve rearing and outmigration flows and related habitat conditions and provide adequate temperatures for fall-run chinook salmon in the Bear River; and contribute to improved conditions for survival of Sacramento basin fall-run chinook salmon migrating through the Sacramento River and the Delta, and benefit other riverine and estuarine species, including other anadromous fish, through contribution to Sacramento River flows and Delta outflows.
4	Over-summering (June through September)	Improve rearing habitat for over-summering juvenile chinook salmon and steelhead.

Recommendations

The remaining three recommendations come from the Working Paper, including results of a cited PHABSIM analyses. The Working Paper salmon and PHABSIM recommendations are for normal and above water-year types and the Working Paper sturgeon recommendation is only for above normal and wet water-year types. These recommendations are specified for the Wheatland gage below Camp Far West Reservoir. Water-year types for the Working Paper recommendations are based on the Sacramento River Index used in the SWRCB Draft Water Right Decision 1630. Flows for October through January are based on the water-year type for the previous year. The Working Paper salmon and steelhead recommendation considers flows that will create passage for salmon and steelhead and provide favorable water temperatures in most months. The difference between the PHABSIM salmon recommendation and the Working Paper salmon recommendation is that PHABSIM values only
represent interpreted physical habitat needs of rearing salmon from January to June. The rationale for the sturgeon recommendation is based on previous years flow conditions during above-normal and wet years when sturgeon production has been qualitatively been classified as good.

Draft Guidelines for Allocation of Acquired Water

Table 2 shows guidelines for allocation of water acquired pursuant to Section 3406(b)(3) of the CVPIA for use on the Bear River.

Table 2. Guidelines for Allocation of Acquired Water for Use on the Bear River

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Support
1	Spawning and incubation (October through December)	40	40	AFRP Working Paper (USFWS 1995) minimum releases to the lower Bear River for normal and wetter water-year types, without releases targeted specifically for sturgeon.
2	Rearing and outmigration (April through May)	9	49	PHABSIM minimum releases for normal and wetter water-year types as cited in the AFRP Working Paper (USFWS 1995).

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Support
3	Incubation and rearing (January through March)	32	81	PHABSIM minimum releases for normal and wetter water-year types as cited in the AFRP Working Paper (USFWS 1995).
4	Over-summering (June through September)	14	95	AFRP Working Paper (USFWS 1995) minimum releases to the lower Bear River for normal and wetter water-year types, without releases targeted specifically for sturgeon.
5	Rearing and outmigration (April through May)	18	113	AFRP Working Paper (USFWS 1995) minimum releases to the lower Bear River for normal and wetter water-year types, without releases targeted specifically for sturgeon.
6	Incubation and rearing (January through March)	11	124	AFRP Working Paper (USFWS 1995) minimum releases to the lower Bear River for normal and wetter water-year types, without releases targeted specifically for sturgeon.
7	Sturgeon migration and spawning (February through March)	77	201	AFRP Working Paper (USFWS 1995) for minimum flow releases for above normal and wetter water-year types, including releases targeted specifically for sturgeon.
8	Sturgeon spawning and requirements for early life-history stages of the progeny (April through May)	79	280	AFRP Working Paper (USFWS 1995) for minimum flow releases for above normal and wetter water-year types, including releases targeted specifically for sturgeon.

Chapter 26. American River

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Target 1: Develop and implement an ecologically based streamflow regulation plan for the American Basin creeks and lower American River. The lower American River should meet the recommended minimum flows and flow targets for the lower American River (*presented in ERPP Tables 9 and 10, below).* Lower American River flow events should be coordinated with similar flows that occur naturally in the Sacramento Valley and with storage releases from Shasta and Oroville Reservoirs (♦ ♦ ♦). (ERPP Vol. II, Page 299)

Programmatic Action IA: Provide target flows by modifying CVP operations and acquiring water as needed from willing sellers, with consideration given to reservoir available carryover storage and flows needed to meet needs determined by the water temperature objective discussed under Target 3 below. (ERPP Vol. II, Page 299)

Programmatic Action 1C: Acquire water from willing sellers to augment river flow during dry years to provide fishery benefits. (ERPP Vol. II, Page 299)

ERPP Table 9. Average Monthly Minimum Flow Targets (cfs) on the American River.
(ERPP Vol. II, Page 300)

	Water-Year Type			
Month	Wet	Above and Below Normal	Dry and Critical	Critical Relaxation
October	2,500	2,000	1,750	800
November–February	2,500	2,500	1,750	1,200
March–May	4,500	3,000	2,000	1,500
June	4,500	3,000	2,000	500
July	2,500	2,500	1,500	500
August	2,500	2,000	1,000	500
September	2,500	1,500	500	500

ERPP Table 10. Average Flow Targets for 10-day Pulse (cfs) on the American River, Coordinated with Flows from Shasta and Oroville Reservoirs. (ERPP Vol. II, Page 300)

	Water-Year Type			
Month	Wet	Above and Below Normal	Dry	Exceptions
March	6,000–7,000	4,000–5,000	3,000–3,500	Only when inflows are sufficient
Late April or early May	7,000–8,000	5,000–6,000	3,500–4,000	Only when inflows are sufficient

Target 2: Minimize flow fluctuations below Nimbus Dam that can dewater salmonid redds and reduce survival of juvenile anadromous fishes due to stranding and/or isolation from the main channel. (♦ ♦ ♦). (ERPP Vol. II, Page 299–300)

Programmatic Action 2A: Complete on-going collaborative efforts to develop flow ramping criteria and operationally implement these criteria to reduce adverse affect of flow fluctuations on lower American River fishery resources. (ERPP Vol. II, Page 300)

Programmatic Action 2B: To minimize dewatering of salmon and steelhead redds, flows exceeding 2,500 cfs after the onset of chinook salmon spawning should be maintained at least at this level until April 30. (ERPP Vol. II, Page 300)

Target 3: Provide flows of suitable quality water that more closely emulate natural annual and seasonal streamflow patterns in American Basin watersheds (♦ ♦).(ERPP Vol. II, Page 300)

Programmatic Action 3A: Enter into agreements with water districts and wetland managers to provide return flows of high quality water from irrigated agriculture and seasonal wetlands to the American Basin. (ERPP Vol. II, Page 300)

Programmatic Action 3B: Enter into agreements with landowners and water districts to limit diversions of natural flows from creeks to improve stream flows. (ERPP Vol. II, Page 300)

Programmatic Action 3C: Limit diversion of natural stream flows from American Basin creeks into irrigation canals and ditches by providing other sources of water or through purchase of water rights from willing sellers. (ERPP Vol. II, Page 300)

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

The American River is an AFRP high priority river.

➔**Action 1 (High Priority).** Develop and implement a river regulation plan that meets the following flow objectives by modifying CVP operations, using (b)(2) water, and acquiring water from willing sellers as needed. Involved Parties: Sacramento Area Water Forum (SAWF), CDFG, USBR, USFWS. (AFRP, Page 76)

	American River minimum flow objectives[a] (cfs)			
Month	Wet[b]	Above and below normal	Dry and critical	Critical relaxation
October	2,500	2,000	1,750	800
November–February	2,500	2,000	1,750	1,200
March–May	4,500	3,000	2,000	1,500
June	4,500	3,000	2,000	500
July	2,500	2,500	1,500	500
August	2,500	2,000	1,000	500
September	2,500	1,500	500	500

[a]A multi-agency and interested party management team should be formed to review and adjust flows in consideration of carryover storage and hydrologic conditions as needed to provide for the long-term needs of anadromous fish. Flow objectives should be met for the entire reach of the American River downstream of Nimbus Dam.
[b] Year types should be based on an American River index, or on consideration of carryover storage and hydrologic conditions in the American River watershed.

➔**Action 2 (High Priority).** Develop a long-term water allocation plan for the American River watershed. Involved Parties: SAWF, CDFG, other water users, USFWS, USBR. (AFRP, Page 77)

➔**Action 3 (High Priority).** Reduce and control flow fluctuations to avoid and minimize adverse effects on juvenile salmonids. Involved Parties: USFWS, USBR, CDFG. (AFRP, Page 77)

Action 7 (Medium Priority). Modify the timing and rate of water diverted from the river annually to reduce entrainment losses of juvenile salmonids. Involved Parties: City of Sacramento, other water users, CDFG, USFWS, USBR. (AFRP, Page 78)

➔**Action 10 (High Priority).** Increase flows for American shad migration, spawning, incubation and rearing from April to June, by modifying CVP operations, by using dedicated water, and by acquiring water from willing sellers, consistent with actions to protect chinook salmon and steelhead and when hydrologic conditions are adequate to minimize adverse effects to water supply operations. Involved Parties: SAWF, USFWS, USBR, CDFG. (AFRP, Page 78)

Evaluation 1 (High Priority). Evaluate the effectiveness of pulse flows to facilitate successful emigration of juvenile salmonids. Involved Parties: USFWS, USBR, CDFG. (AFRP, Page 79)

Evaluation 2 (High Priority). Evaluate and refine a river regulation plan that provides flows to protect all life stages of anadromous fish based on water storage at Folsom Reservoir and predicted hydrologic conditions in the American River watershed. Involved Parties: SAWF, CDFG, USFWS, USBR. (AFRP, Page 79)

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Not included in the guidelines.

Chapter 27. Yolo Basin

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Target 1: More closely emulate natural seasonal patterns in Cache and Putah Creeks by providing additional flows, when available from existing water supplies. Flows in the Yolo Bypass would be supplemented, as needed, by the Colusa basin drain through the Knights Landing Ridge Cut Canal, extending the Tehama–Colusa Canal, and the Sacramento River through the Fremont weir. Supplemental flows may be needed in fall if water temperature and flow in the lower Yolo Bypass are insufficient for passage from Cache Slough to upstream areas in the Sacramento River. Supplemental flows may be needed in winter and spring to sustain downstream migrating juvenile salmon and steelhead on their journey through the Yolo Bypass to the Delta. Supplemental flows would be needed along with irrigation water from spring to fall to sustain native fish, wetlands, and riparian habitats in channel sloughs of the Yolo Bypass (♦♦). (ERPP Vol. II, Page 322)

Programmatic Action 1C: Cooperatively evaluate the feasibility of providing water for the upper Yolo Bypass portion of the Cache Creek Unit by redirecting water from Colusa basin drain through the Knights Landing Ridge Cut Canal, an extension of the Tehama–Colusa Canal, and the Sacramento River through the Grays Bend–Old River–Fremont weir complex. (ERPP Vol. II, Page 322)

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

No flow-related actions listed.

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Not included in the guidelines.

Chapter 28. Cache Creek

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Target 1: More closely emulate natural seasonal patterns in Cache and Putah Creeks by providing additional flows, when available from existing water supplies. Flows in the Yolo Bypass would be supplemented, as needed, by the Colusa basin drain through the Knights Landing Ridge Cut Canal, extending the Tehama–Colusa Canal, and the Sacramento River through the Fremont weir. Supplemental flows may be needed in fall if water temperature and flow in the lower Yolo Bypass are insufficient for passage from Cache Slough to upstream areas in the Sacramento River. Supplemental flows may be needed in winter and spring to sustain downstream migrating juvenile salmon and steelhead on their journey through the Yolo Bypass to the Delta. Supplemental flows would be needed along with irrigation water from spring to fall to sustain native fish, wetlands, and riparian habitats in channel sloughs of the Yolo Bypass (♦♦). (ERPP Vol. II, Page 322)

Programmatic Action 1A: Develop a cooperative program to provide water for summer flows in Cache Creek to maintain riparian vegetation by developing new conjunctive supplies, including groundwater. (ERPP Vol. II, Page 322)

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

No flow-related actions listed.

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Not included in the guidelines.

Chapter 29. Putah Creek

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Target 1: More closely emulate natural seasonal patterns in Cache and Putah Creeks by providing additional flows, when available from existing water supplies. Flows in the Yolo Bypass would be supplemented, as needed, by the Colusa basin drain through the Knights Landing Ridge Cut Canal, extending the Tehama-Colusa Canal, and the Sacramento River through the Fremont weir. Supplemental flows may be needed in fall if water temperature and flow in the lower Yolo Bypass are insufficient for passage from Cache Slough to upstream areas in the Sacramento River. Supplemental flows may be needed in winter and spring to sustain downstream migrating juvenile salmon and steelhead on their journey through the Yolo Bypass to the Delta. Supplemental flows would be needed along with irrigation water from spring to fall to sustain native fish, wetlands, and riparian habitats in channel sloughs of the Yolo Bypass (♦♦). (ERPP Vol. II, Page 322)

Programmatic Action 1B: Develop a cooperative program to provide water for the target flows in Putah Creek from additional Lake Berryessa releases or reductions in water diversions at Solano Diversion Dam and in the creek downstream of the dam. Water would be obtained from willing sellers, water transfers, and by developing new supplies, including groundwater. (ERPP Vol. II, Page 322)

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

No flow-related actions listed.

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Not included in the guidelines.

Chapter 30. West San Joaquin Basin

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Target 1: Provide flows of suitable quality water that more closely emulate (imitate) natural annual and seasonal streamflow patterns in West San Joaquin tributary watersheds. Provide a total watershed flow of 250 to 500 cfs to the San Joaquin River in dry and normal years for a 10-day period in late April to early May (approximately 5,000 to 10,000 af) (♦). (ERPP Vol. II, Page 416)

Programmatic Action 1A: Enter into agreements with water districts and wetland managers to provide return flows of high quality water from irrigated agriculture and seasonal wetlands to the San Joaquin River. (ERPP Vol. II, Page 416)

Programmatic Action 1B: Enter into agreements with landowners and water districts to limit diversions of natural flows from streams to improve streamflows. (ERPP Vol. II, Page 416)

Programmatic Action 1C: Make seasonal releases from the California Aqueduct or Delta-Mendota Canal into streams and wetlands. (ERPP Vol. II, Page 416)

Programmatic Action 1D: Limit capture of natural stream flows from westside tributaries into irrigation canals and ditches and State and federal aqueducts. (ERPP Vol. II, Page 416)

Habitats, Seasonal Wetland Habitats

Target 2: Provide 150,000 af of water to existing wetlands to improve waterfowl ,habitat (♦).(ERPP Vol. II, Page 417)

Programmatic Action 2A: Provide water to wetlands on a seasonal basis from the California Aqueduct, Delta-Mendota Canal, or other source. (ERPP Vol. II, Page 417)

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

No flow-related actions listed.

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Not included in the guidelines.

Chapter 31. San Joaquin River

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Target 1: Manage flow releases from tributary streams to provide adequate upstream and downstream passage of fall-run and late fall–run chinook salmon, resident rainbow trout, and steelhead and spawning and rearing habitat for American shad, splittail, and sturgeon from the Merced River confluence to Vernalis (♦♦). (ERPP Vol. II, Page 365)

Programmatic Action 1A: Develop a cooperative program to purchase water from willing sellers or develop alternative sources of water. (ERPP Vol. II, Page 365)

Target 2: Manage flow releases from Friant Dam to Gravelly Ford to maintain sustainable populations of resident native fish (♦♦). (ERPP Vol. II, Page 365)

Programmatic Action 2A: Evaluate the feasibility of increasing flows below Friant to restore terrestrial and aquatic habitats for fish and wildlife including anadromous salmonids. (ERPP Vol. II, Page 365)

Target 3: Optimize the ecological value of wet year flood releases below Friant Dam (♦♦). (ERPP Vol. II, Page 365)

Programmatic Action 3A: Evaluate the feasibility of modifying flood operation guidelines and schedules in wet years to include more variable hydrographs with higher peak flows of shorter duration and more overall flow variability. (ERPP Vol. II, Page 365)

Ecological Processes, Central Valley Stream Temperatures

Target 1: Manage reservoir releases and other factors to provide suitable water temperatures for important resources from the Merced River confluence to Vernalis (♦♦).(ERPP Vol. II, Page 367)

Programmatic Action 1A: Evaluate the feasibility of releasing sufficient instream flows to improve the temperature regime for important resources. (ERPP Vol. II, Page 367)

ERPP STRATEGIC PLAN, APPENDIX D

Action 1. Improve instream flows by purchasing water from willing sellers or providing alternative water supplies that will allow diverters to reduce diversions. (Note: this water will be part of the 100 TAF of water purchased to improve stream flows in the Sacramento and San Joaquin Basins.) (Strategic Plan, Page D-41)

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

The San Joaquin River is an AFRP high priority river.

➔**Action 1 (High Priority).** Coordinate with CDFG and others and acquire water from willing sellers consistent with applicable guidelines as needed to implement a flow schedule that improves conditions for all life stages of San Joaquin chinook salmon migrating through, or rearing in, the lower San Joaquin River. Involved Parties: River and tributary water managers and diverters, CDFG, SWRCB, USFWS, USBR. (AFRP, Page 93)

Evaluation 4 (High Priority). Identify and attempt to maintain adequate flows for migration, spawning, incubation and rearing of white sturgeon and green sturgeon from February to May, consistent with actions to protect chinook salmon and steelhead and when hydrologic conditions are adequate to minimize adverse effects to water supply operations. Involved Parties: River and tributary water managers and diverters, CDFG, DWR. (AFRP, Page 95)

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Not included in the guidelines.

Chapter 32. Stanislaus River

ERPP VOL. II

Ecological Processes, Central Valley Streamflows

Target 1: Maintain the following base flows in the Stanislaus River below Goodwin Dam (♦ ♦):

in critical, dry, and below-normal years, minimum flows should be 200 to 300 cfs, except for a flow event of 1,500 cfs for 30 days in April and May,

in above-normal years, minimum flows should be 300 to 350 cfs, except for 800 cfs in June and 1,500 cfs in April and May, and

in wet years, minimum flows should be 300 to 400 cfs, except for 1,500 cfs from April through June. (ERPP Vol. II, Page 396)

Programmatic Action 1A: Develop a cooperative approach to coordinate flow releases to attain target levels. (ERPP Vol. II, Page 396)

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

The Stanislaus River is an AFRP high priority river.

➔**Action 1 (High Priority).** Implement an interim river regulation plan that meets the following flow schedule by supplementing the 1987 agreement between USBR and CDFG[a], through reoperation of New Melones Dam, use of (b)(2) water, and acquisition of water from willing sellers as needed. Involved Parties: CDFG, USFWS, USBR, Oakdale Irrigation District,

South San Joaquin Irrigation District, Stockton East Water District, Central San Joaquin Water Conservation District, South Delta Water Agency (SDWA), COE. (AFRP, Page 90)

Month	Stanislaus River flow schedule (cfs) by year type[b]				
	Wet	Above normal	Below normal	Dry	Critical
October	350	350	250	250	200
November–March	400	350	300	275	250
April	1,500	1,500	300/1500[c]	300/1500[d]	300/1500[e]
May	1,500	1,500	1500/300[c]	1500/300[d]	1500/300[e]
June	1,500	800	250	200	200
July–September	300	300	250	200	200
Total (TAF)	468	410	313	257	247
Baseline (TAF)	1,015	722	406	242	269
Unimpaired (TAF)	1,772	1,291	920	631	449

[a]Existing flow requirements are 98 to 302 TAF, based on the 1987 agreement between CDFG and USBR (CDFG and USBR 1987); actual schedule is determined on an annual basis and depends on available yield, carryover storage, and hydrologic conditions.
[b]Year type based on San Joaquin basin 60-20-20 index. Flow schedules are released from Goodwin Dam.
[c]In a below normal water year, April–May flow would be maintained for 45 days and 1500 cfs and 16 days at 300 cfs.
[d]In a dry water year, April–May flow would be maintained for 30 days at 1500 cfs and 31 days at 300 cfs.
[e]In a critical water year, April–May flow would be maintained at 1500 cfs for 30 days and 300 cfs for 31 days.

➔**Evaluation 3 (High Priority).** Evaluate and refine a river regulation plan that provides adequate flows to protect all life stages of anadromous fish based on water storage at New Melones Reservoir, predicted hydrologic conditions, and current aquatic habitat conditions. Involved Parties: USFWS, USBR, CDFG, COE. (AFRP, Page 91)

Evaluation 5 (High Priority). Evaluate use of the Stanislaus River by American shad and consider increasing flows and maintaining mean daily water temperatures between 61ºF and 65ºF from April to June when hydrologic conditions are adequate to minimize adverse effects to water supply operations and in a manner consistent with actions to protect chinook salmon. Involved Parties: Dam operators, CDFG, USFWS, USBR. (AFRP, Page 92)

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Species and Life History–Stage Priorities

The primary species of concern in the Stanislaus River is fall-run chinook salmon. Late fall–run chinook salmon and steelhead may also be present. Table 1 prioritizes life-history stages for use in conjunction with the existing standards to generate guidelines for allocation of acquired water in the Stanislaus River. The time periods in parentheses in the life history–stage

column are approximate time periods when that life-history stage is present in the river. Actual time periods vary, dependent on run-timing, environmental conditions, and rate of development.

Table 1. Draft Water Allocation Priorities for Water on the Stanislaus River

Priority	Life-history stage	Objective
1	Spawning and incubation (October through December)	Improve attraction flows and provide adequate water temperatures for fall-run chinook salmon migrating into and spawning and incubating in the Stanislaus River.
3	Incubation and rearing (January through March)	Improve spawning, incubating, and rearing flows and related habitat conditions for fall-run chinook salmon, and benefit sturgeon, striped bass, and other species through contribution to San Joaquin River flows and Delta outflows.
2	Rearing and outmigration (April through May)	Improve rearing and outmigration flows and related habitat conditions and provide adequate temperatures for fall-run chinook salmon in the Stanislaus River; and contribute to improved conditions for survival of San Joaquin basin and Delta tributary fall-run chinook salmon migrating through the San Joaquin River and the Delta, and benefit other riverine and estuarine species, including other anadromous fish, through contribution to San Joaquin River flows and Delta outflows.
4	Over-summering (June through September)	Improve rearing habitat for over-summering juvenile chinook salmon and steelhead.

Recommendations

Flow recommendations have been made by the CDFG and USFWS. The USFWS made flow recommendations based on an instream flow study and subsequently identified additional flow needs in the AFRP Working Paper.

California Department of Fish and Game: The CDFG (1993) provides interim flow recommendations for the Stanislaus River. Recommendations are intended to improve conditions for fall-run chinook salmon. Recommendations are based on results of an instream flow study conducted by the USFWS (Aceituno 1993) for October through March and smolt survival studies conducted by CDFG for April through May. Recommendations are provided for five water-year types in the 60-20-20 index of the San Joaquin River basin, ranging from 185,280 to 381,498 af. The recommendations also include blocks of water to be used for spawner attraction in October and outmigration in April and May.

USFWS Instream Flow Study: The USFWS has provided recommendations based on an instream flow study using IFIM (IFIM; Aceituno 1993). Flows were to provide adequate spawning, incubation, and rearing habitats for fall-run chinook salmon. A total of about 155,000 af is recommended, irrespective of water-year type. The study noted that to protect and preserve chinook salmon in the Stanislaus River, a comprehensive instream flow regime would need to consider factors that were not included in the IFIM study, such as water quality, temperature, attraction flows, and flow for juvenile emigrations.

AFRP Working Paper: The AFRP identified flow needs that, in conjunction with other restoration actions, would result in at least doubling natural production of fall-run chinook

salmon relative to the average attained during 1967–1991. The needs were based on an IFIM study (Aceituno 1993), the proportion of unimpaired flow that the Stanislaus River contributes to the San Joaquin River, and the historic hydrological regime. Assumptions were that flows greater than historical flows in the lower reach of the river are needed to compensate for elimination of access to upstream habitat, and flows should not be reduced between spawning and outmigration to prevent redd dewatering and stranding of rearing juveniles. Recommendations were made for five water-year types, according to the San Joaquin River 60-20-20 Index. The identified that flows ranged from 290,000 to 943,000 af.

Draft Guidelines for Allocation of Acquired Water

The following tables show the draft guidelines for allocation of water managed under sections 3406(b)(1), (b)(2), and (b)(3) of the CVPIA. Allocations were developed relative to two water-year types established by the existing standards. A process to determine sources of water allocated in excess of the existing standards (i. e., from sections 3406(b)(1), (b)(2), and (b)(3) of the CVPIA) is being developed.

Table 2 shows draft guidelines for allocation of water for use on Stanislaus River in critical to above normal water years. The time periods in parentheses in the targeted life history–stage column are approximate time periods when the block of water identified in the block of water column would be allocated for the benefit of the targeted life-history stage. Actual time periods will be based on real-time observations of run-timing, rate of development, and behavior of chinook salmon in the Stanislaus River. The block of water will be managed to maximize benefits to anadromous fish, both in the Stanislaus River and downstream, and in coordination with downstream water managers.

Table 2. Draft Guidelines for Allocation of Water for Use on Stanislaus River in Critical to Above Normal Water Years

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
1	Spawning and incubation (October through December)	21	21	USFWS (Aceituno 1993) recommended minimum releases for spawning and incubation.
2	Incubation and rearing (January through March)	9	30	USFWS (Aceituno 1993) recommended minimum releases for incubation and rearing.
3	Spawning and incubation (October through December)	7	37	CDFG (1993) recommended minimum releases for a critical water year.
4	Incubation and rearing (January through March)	4	41	CDFG (1993) recommended minimum releases for a critical water year.

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
5	Spawning and incubation (October through December)	5	46	CDFG (1993) recommended minimum releases for a dry water year.
6	Rearing and outmigration (April through May)	24	70	CDFG (1993) recommended minimum releases for a dry water year.
7	Incubation and rearing (January through March)	5	75	CDFG (1993) recommended minimum releases for a dry water year.
8	Spawning and incubation (October through December)	4	79	CDFG (1993) recommended minimum releases for a below normal water year.
9	Rearing and outmigration (April through May)	27	106	CDFG (1993) recommended minimum releases for a below normal water year.
10	Incubation and rearing (January through March)	4	110	CDFG (1993) recommended minimum releases for a below normal water year.
11	Over-summering (June through September)	5	115	CDFG (1993) recommended minimum releases for a below normal water year.
12	Rearing and outmigration (April through May)	16	131	AFRP Working Paper (USFWS 1995) minimum releases for a critical water year.
13	Incubation and rearing (January through March)	22	153	AFRP Working Paper (USFWS 1995) minimum releases for a critical water year.
14	Over-summering (June through September)	42	195	Existing standard for a wet water year.
15	Spawning and incubation (October through December)	8	203	CDFG (1993) recommended minimum releases for an above normal water year.
16	Rearing and outmigration (April through May)	48	251	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year.
17	Incubation and rearing (January through March)	17	268	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year.
18	Spawning and incubation (October through December)	9	277	CDFG (1993) recommended minimum releases for a wet water year.
19	Rearing and outmigration (April through May)	70	347	AFRP Working Paper (USFWS 1995) minimum releases for a below normal water year.
20	Incubation and rearing (January through March)	26	373	AFRP Working Paper (USFWS 1995) releases for a below normal water year.

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
21	Over-summering (June through September)	26	399	AFRP Working Paper (USFWS 1995) minimum releases for a below normal water year.
22	Rearing and outmigration (April through May)	46	445	AFRP Working Paper (USFWS 1995) minimum releases for an above normal water year.
23	Incubation and rearing (January through March)	74	519	AFRP Working Paper (USFWS 1995) minimum releases for an above normal water year.
24	Over-summering (June through September)	27	543	AFRP Working Paper (USFWS 1995) minimum releases for an above normal water year.
25	Spawning and incubation (October through December)	13	556	AFRP Working Paper (USFWS 1995) minimum releases for a wet water year.
26	Rearing and outmigration (April through May)	64	607	AFRP Working Paper (USFWS 1995) minimum releases for a wet water year.
27	Incubation and rearing (January through March)	62	669	AFRP Working Paper (USFWS 1995) minimum releases for a wet water year.
28	Over-summering (June through September)	100	769	AFRP Working Paper (USFWS 1995) minimum releases for a wet water year.

Table 3 shows draft guidelines for allocation of water for use on Stanislaus River in wet water years. The time periods in parentheses in the targeted life history–stage column are approximate time periods when the block of water identified in the block of water column would be allocated for the benefit of the targeted life-history stage. Actual time periods will be based on real-time observations of run-timing, rate of development, and behavior of chinook salmon in the Stanislaus River. The block of water will be managed to maximize benefits to anadromous fish, both in the Stanislaus River and downstream, and in coordination with downstream water managers.

Table 3. Draft Guidelines for Allocation of Water for Use on Stanislaus River in Wet Water Years

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
1	Spawning and incubation(October through December)	21	21	CDFG (1993) recommended minimum releases for an above normal water year.
2	Rearing and outmigration (April through May)	70	91	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year.
3	Incubation and rearing (January through March)	30	121	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year.

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
4	Spawning and incubation (October through December)	9	130	CDFG (1993) recommended minimum releases for a wet water year.
5	Rearing and outmigration (April through May)	69	199	AFRP Working Paper (USFWS 1995) minimum releases for a below normal water year.
6	Incubation and rearing (January through March)	26	225	AFRP Working Paper (USFWS 1995) minimum releases for a below normal water year.
7	Over-summering (June through September)	27	252	AFRP Working Paper (USFWS 1995) minimum releases for a below normal water year.
8	Rearing and outmigration (April through May)	46	298	AFRP Working Paper (USFWS 1995) minimum releases for an above normal water year.
9	Incubation and rearing (January through March)	74	372	AFRP Working Paper (USFWS 1995) minimum releases for an above normal water year.
10	Over-summering(June through September)	27	399	AFRP Working Paper (USFWS 1995) minimum releases for an above normal water year.
11	Spawning and incubation (October through December)	13	412	AFRP Working Paper (USFWS 1995) minimum releases for a wet water year.
12	Rearing and outmigration (April through May)	64	476	AFRP Working Paper (USFWS 1995) minimum releases for a wet water year.
13	Incubation and rearing (January through March)	64	540	AFRP Working Paper (USFWS 1995) minimum releases for a wet water year.
14	Over-summering (June through September)	99	639	AFRP Working Paper (USFWS 1995) minimum releases for a wet water year.

Chapter 33. Tuolumne River

ERPP VOL. II

No flow-related actions listed.

ERPP STRATEGIC PLAN, APPENDIX D

Action 5. Purchase water from willing sellers to increase the magnitude of fall flows. (Note: this water will be part of the 100 TAF of water purchased to improve stream flows in the Sacramento and San Joaquin Basins.) (Strategic Plan, Page D-38)

Action 6. Explore actions to reduce ambient water temperatures, including increasing flows by purchasing water from willing sellers or developing new water supplies, as well as protecting and restoring riparian habitat. (Strategic Plan, Page D-39)

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

The Tuolumne River is an AFRP high priority river.

➔**Action 1 (High Priority).** Implement a flow schedule as specified in the terms of the FERC order resulting from the New Don Pedro Project (FERC Proceeding P-2299-024). Supplement FERC agreement flows with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements as needed to improve conditions for all life-history stages of chinook salmon. Involved Parties: City and County of San Francisco, Turlock Irrigation District (TID), Modesto Irrigation District (MID), Lower Tuolumne River Technical Advisory Committee (LTTAC), FERC, USFWS, USBR. (AFRP, Page 87)

Evaluation 3 (High Priority). Evaluate the effects of flow fluctuations established by the guidelines of the FERC Settlement Agreement on spawning, incubation, and rearing of chinook salmon, and if substantial adverse effects are indicated, modify guidelines to reduce effects. Involved Parties: Diverters, Hydropower operators, LTTAC, CDFG, USFWS, USBR. (AFRP, Page 89)

Evaluation 4 (High Priority). Evaluate fall pulse flows for attraction and passage benefits to chinook salmon and steelhead. Involved Parties: Diverters, Hydropower operators, LTTAC, CDFG, USFWS, USBR. (AFRP, Page 89)

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(B)(3) OF THE CVPIA

Species and Life History–Stage Priorities

On the Tuolumne River, the primary species of concern is fall-run chinook salmon. Steelhead may also be present in some years, but natural production of steelhead in the river is unlikely. Although the AFRP Working Paper provided flows for American shad, these flows were less than those needed for chinook salmon. Table 1 prioritizes life-history stages for use in conjunction with the existing standards to generate guidelines for allocation of acquired water in the Tuolumne River. This table is an adaptation of the tables the long-term water management planning team has produced. The priorities and objectives were generated based on Roger Guinee's preliminary draft recommendations for the Tuolumne River and on input from Bill Loudermilk of CDFG.

Table 1 shows draft water allocation priorities for (b)(3) water on the Tuolumne River. The time periods in parentheses in the life history–stage column are approximate time periods when that life-history stage is present in the river. Actual time periods vary, dependent on run-timing, environmental conditions, and rate of development.

Table 1. Draft Water Allocation Priorities for (b)(3) Water on the Tuolumne River

Priority	Life-history stage	Objective
1	Spawning and incubation (October through December)	Improve attraction flows and provide adequate water temperatures for fall-run chinook salmon migrating into and spawning and incubating in the Tuolumne River.
3	Incubation and rearing (January through March)	Improve spawning, incubating, and rearing flows and related habitat conditions for fall-run chinook salmon, and benefit sturgeon, striped bass, and other species through contribution to San Joaquin River flows and Delta outflows.
2	Rearing and outmigration (April through May)	Improve rearing and outmigration flows and related habitat conditions and provide adequate temperatures for fall-run chinook salmon in the Tuolumne River; and contribute to improved conditions for survival of San Joaquin basin and Delta tributary fall-run chinook salmon migrating through the San Joaquin River and the Delta, and benefit other riverine and estuarine species, including other anadromous fish, through contribution to San Joaquin River flows and Delta outflows.
4	Over-summering (June through September)	Improve rearing habitat for over-summering juvenile chinook salmon and steelhead.

Recommendations

Turlock Irrigation District, Merced Irrigation District, California Department of Fish and Game The District's and CDFG recommendation defines specific flow schedules for different times of the year, including spring pulse flows for smolt out-migration for 10 different water-year types. Water allocation by year type ranges from a low of 64 TAF to 374 TAF. Water-year types are calculated based on actual and predicted regulated inflows to New Don Pedro Reservoir. The year type classification is reassessed multiple times during each year incorporating recent inflow and updated inflow predictions. This recommendation results in a general annual unimodal release schedule with a maxima in the spring, and thus is somewhat representative of the natural hydrograph.

City and County of San Francisco: The City and County of San Francisco (CCSF) recommendation defines 11 different water-year types allocating a minimum of 64 TAF in the driest years to a maximum of 250 TAF in the wettest year types. CCSF water-year types are defined using unimpaired flows at the La Grange gage. Water-year types are calculated and redefined on April 15, May 15, and June 15, and are based on the sum of year-to-date and forecasted unimpaired runoff. This recommendation is bimodal with a two-day fall attraction flow specified for October and increased flows for outmigration in May, summer rearing flows are also provided.

U. S. Fish and Wildlife Service: The USFWS flow recommendation integrates the relationship between temperature and flow, and flow and physical habitat recognizing that habitat components in addition to physical space should be considered in flow allocation. The USFWS produced annual flow schedules for four different water-year types, ranging in a minimum annual release of 120 TAF to a maximum of 304 TAF. Water years are partitioned based on unimpaired flow in the Tuolumne basin; however, the USFWS has not identified a specific method to determine how forecasts are to be used to determine unimpaired flow or the dates on which water-year types would be evaluated. Differing from the standard and the two previous recommendations no specific pulse or attraction flows are built into the minimum flow schedules.

Federal Energy Regulatory Commission Staff: FERC describes only three water-year types that allocate minimum annual totals of water ranging from 84 TAF to 376 TAF. The year types are defined using unimpaired annual flow at the La Grange gage, similar to the definition of water-year type used by the CCSF and FWS but differing in breakpoint definition resulting in the three water-year types. FERC staff used a water balance model, the Hetch-Hetchy Simulation Model (HHSM), and a salmon production model or the Oak Ridge Chinook Model (ORCM) to generate minimum instream flow recommendations that attempt to maximize both fishery and water user benefits and minimize costs to both. The ORCM model uses spawner escapement, daily flow data, water and air temperature and WUA data to produce smolt production estimates in this individual based model. For years of normal and wet hydrology FERC staff used an iterative process with HHSM model to generate a minimum instream flow that produced the highest number of salmon smolts. Then they capped the minimum annual flow at 357 TAF, the level where smolt increase per unit flow increased approached zero. From this cap, additional fall

attraction flows were added, because this aspect of life history is not well accounted for in the model. Also, additional summer flows were added to provide for other non-salmon objectives. In critical and dry years a similar iterative process was followed but they incorporated a balance between the ORCM model and the ORCM model.

AFRP Working Paper: The AFRP Working Paper presents minimum instream flows for five water-year types and allocates minimum annual totals of water ranging from 411 TAF to 1,544 TAF. Water-year types are based on the San Joaquin Basin 60-20-20 index described above for the existing standard. The Working Paper recommendations produce a unimodal fish allocation that peaks in the spring. Recommended fall and summer flow are derived from IFIM data. Winter and spring flow recommendations were guided both by historical monthly distribution of total annual unimpaired runoff for the Tuolumne River Basin and Vernalis flow requirements. The intent of the Working Paper flow recommendations was contribute to doubling production of Tuolumne River fall-run chinook salmon and to provide benefit to anadromous fish downstream in the San Joaquin River and Delta.

Draft Guidelines for Allocation of Acquired Water

The following tables show the draft guidelines for allocation of acquired water for each of the water-year types for which the existing standards were developed. The guidelines for each of the water-year types are bracketed on the lower end by the standard for the year type and on the upper end by the AFRP Working Paper flows that apply to the year type. Ultimately, I expect that the upper-end bracket will be determined by the PEIS estimate of the amount of water available for acquisition, rather than by the Working Paper flows.

Table 2 shows draft guidelines for allocation of water acquired pursuant to Section 3406(b)(3) of the CVPIA for use on the Tuolumne River in critical and below normal water years. The time periods in parentheses in the targeted life history–stage column are approximate time periods when the block of water identified in the block of water column would be allocated for the benefit of the targeted life-history stage. Actual time periods will be based on real-time observations of run-timing, rate of development, and behavior of chinook salmon in the Tuolumne River. The block of water will be managed to maximize benefits to anadromous fish, both in the Tuolumne River and downstream, and in coordination with the Lower Tuolumne River Technical Advisory Committee and downstream water managers.

Table 2. Draft Guidelines for Allocation of Acquired Water for Use on the Tuolumne River in Critical and Below Normal Water Years

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
1	Rearing and outmigration (April through May)	9	9	New Don Pedro Proceeding Settlement Agreement (Settlement Agreement) minimum releases for a median critical water year.

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
2	Spawning and incubation (October through December)	1	10	Settlement Agreement minimum releases for an intermediate critical-dry water year.
3	Rearing and outmigration (April through May)	17	27	Settlement Agreement minimum releases for intermediate critical-dry and median dry water years.
4	Over-summering (June through September)	6	33	Settlement Agreement minimum releases for a median dry water year.
5	Spawning and incubation (October through December)	7	40	Settlement Agreement minimum releases for an intermediate dry-below normal water year.
6	Rearing and outmigration (April through May)	2	42	Settlement Agreement minimum releases for an intermediate dry-below normal water year.
7	Incubation and rearing (January through March)	5	47	Settlement Agreement minimum releases for an intermediate dry-below normal water year.
8	Rearing and outmigration (April through May)	24	71	Settlement Agreement minimum releases for a median below normal water year.
9	Spawning and incubation (October through December)	26	97	Settlement Agreement minimum releases for median above normal and wetter water years.
10	Rearing and outmigration (April through May)	45	142	Settlement Agreement minimum releases for median above normal and wetter water years.
11	Incubation and rearing (January through March)	22	164	Settlement Agreement minimum releases for median above normal and wetter water years.
12	Over-summering (June through September)	42	206	Settlement Agreement minimum releases for median above normal and wetter water years.
13	Rearing and outmigration (April through May)	29	235	TID and MID (1992) recommended minimum releases for an intermediate above normal/wet water year.
14	Spawning and incubation (October through December)	20	255	USFWS (1993) recommended minimum releases a critical water year.
15	Rearing and outmigration (April through May)	18	273	FERC (1996) staff recommended minimum releases for a normal/wet water year based on FERC's experience with a salmon production model.
16	Incubation and rearing (January through March)	34	307	FERC (1996) staff recommended minimum releases for a normal/wet water year based on FERC's experience with a salmon production model.
17	Over-summering (June through September)	27	334	FERC (1996) staff recommended minimum releases for a normal/wet water year based on FERC's experience with a salmon production model.
18	Rearing and outmigration (April through May)	38	372	TID and MID (1992) recommended minimum releases for a median wet/maximum water year.

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
19	Incubation and rearing (January through March)	11	383	AFRP Working Paper (USFWS 1995) minimum releases for a critical water year.

Table 3 shows draft guidelines for allocation of water acquired pursuant to Section 3406(b)(3) of the CVPIA for use on the Tuolumne River in median critical water years. See the discussion of Table 2 for a more complete description of the columns and a definition of water-year types.

Table 3. Draft Guidelines for Allocation of Acquired Water for Use on the Tuolumne River in Median Critical Water Years

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
1	Spawning and incubation (October through December)	1	1	Settlement Agreement minimum releases for an intermediate critical-dry water year.
2	Rearing and outmigration (April through May)	17	18	Settlement Agreement minimum releases for intermediate critical-dry and median dry water years.
3	Over-summering (June through September)	6	24	Settlement Agreement minimum releases for a median dry water year.
4	Spawning and incubation (October through December)	7	31	Settlement Agreement minimum releases for an intermediate dry-below normal water year.
5	Rearing and outmigration (April through May)	2	33	Settlement Agreement minimum releases for an intermediate dry-below normal water year.
6	Incubation and rearing (January through March)	5	38	Settlement Agreement minimum releases for an intermediate dry-below normal water year.
7	Rearing and outmigration (April through May)	24	62	Settlement Agreement minimum releases for a median below normal water year.
8	Spawning and incubation (October through December)	26	88	Settlement Agreement minimum releases for median above normal and wetter water years.
9	Rearing and outmigration (April through May)	45	133	Settlement Agreement minimum releases for median above normal and wetter water years.
10	Incubation and rearing (January through March)	22	155	Settlement Agreement minimum releases for median above normal and wetter water years.
11	Over-summering (June through September)	42	197	Settlement Agreement minimum releases for median above normal and wetter water years.
12	Rearing and outmigration (April through May)	29	226	TID and MID (1992) recommended minimum releases for an intermediate above normal/wet water year.
13	Spawning and incubation (October through December)	20	246	USFWS (1993) recommended minimum releases a critical water year.

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
14	Rearing and outmigration (April through May)	18	264	FERC (1996) staff recommended minimum releases for a normal/wet water year based on FERC's experience with a salmon production model.
15	Incubation and rearing (January through March)	34	298	FERC (1996) staff recommended minimum releases for a normal/wet water year based on FERC's experience with a salmon production model.
16	Over-summering (June through September)	27	325	FERC (1996) staff recommended minimum releases for a normal/wet water year based on FERC's experience with a salmon production model.
17	Rearing and outmigration (April through May)	38	363	TID and MID (1992) recommended minimum releases for a median wet/maximum water year.
18	Incubation and rearing (January through March)	11	374	AFRP Working Paper (USFWS 1995) minimum releases for a critical water year.

Table 4 shows draft guidelines for allocation of water acquired pursuant to Section 3406(b)(3) of the CVPIA for use on the Tuolumne River in intermediate critical–dry water years. See the discussion of Table 2 for a more complete description of the columns and a definition of water-year types.

Table 4. Draft Guidelines for Allocation of Acquired Water for Use on the Tuolumne River in Intermediate Critical-Dry Water Years

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
1	Rearing and outmigration (April through May)	2	2	Settlement Agreement minimum releases for a median dry water year.
2	Over-summering (June through September)	6	8	Settlement Agreement minimum releases for a median dry water year.
3	Spawning and incubation (October through December)	7	15	Settlement Agreement minimum releases for an intermediate dry-below normal water year.
4	Rearing and outmigration (April through May)	2	17	Settlement Agreement minimum releases for an intermediate dry-below normal water year.
5	Incubation and rearing (January through March)	5	22	Settlement Agreement minimum releases for an intermediate dry-below normal water year.
6	Rearing and outmigration (April through May)	24	46	Settlement Agreement minimum releases for a median below normal water year.
7	Spawning and incubation (October through December)	26	72	Settlement Agreement minimum releases for median above normal and wetter water years.
8	Rearing and outmigration (April through May)	45	117	Settlement Agreement minimum releases for median above normal and wetter water years.

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
9	Incubation and rearing (January through March)	22	139	Settlement Agreement minimum releases for median above normal and wetter water years.
10	Over-summering (June through September)	42	181	Settlement Agreement minimum releases for median above normal and wetter water years.
11	Rearing and outmigration (April through May)	29	210	TID and MID (1992) recommended minimum releases for an intermediate above normal/wet water year.
12	Spawning and incubation (October through December)	20	230	USFWS (1993) recommended minimum releases a critical water year.
13	Rearing and outmigration (April through May)	18	248	FERC (1996) staff recommended minimum releases for a normal/wet water year based on FERC's experience with a salmon production model.
14	Incubation and rearing (January through March)	34	282	FERC (1996) staff recommended minimum releases for a normal/wet water year based on FERC's experience with a salmon production model.
15	Over-summering (June through September)	27	309	FERC (1996) staff recommended minimum releases for a normal/wet water year based on FERC's experience with a salmon production model.
16	Rearing and outmigration (April through May)	38	347	TID and MID (1992) recommended minimum releases for a median wet/maximum water year.
17	Incubation and rearing (January through March)	11	358	AFRP Working Paper (USFWS 1995) minimum releases for a critical water year.
18	Rearing and outmigration (April through May)	56	414	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year.
19	Incubation and rearing (January through March)	26	440	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year.
20	Over-summering (June through September)	32	472	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year.

Table 5 shows draft guidelines for allocation of water acquired pursuant to Section 3406(b)(3) of the CVPIA for use on the Tuolumne River in median dry water years. See the discussion of Table 2 for a more complete description of the columns and a definition of water-year types.

Table 5. Draft Guidelines for Allocation of Acquired Water for Use on the Tuolumne River in Median Dry Water Years

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
1	Spawning and incubation (October through December)	7	7	Settlement Agreement minimum releases for an intermediate dry-below normal water year.

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
2	Rearing and outmigration (April through May)	2	9	Settlement Agreement minimum releases for an intermediate dry-below normal water year.
3	Incubation and rearing (January through March)	5	14	Settlement Agreement minimum releases for an intermediate dry-below normal water year.
4	Rearing and outmigration (April through May)	24	38	Settlement Agreement minimum releases for a median below normal water year.
5	Spawning and incubation (October through December)	26	64	Settlement Agreement minimum releases for median above normal and wetter water years.
6	Rearing and outmigration (April through May)	45	109	Settlement Agreement minimum releases for median above normal and wetter water years.
7	Incubation and rearing (January through March)	22	131	Settlement Agreement minimum releases for median above normal and wetter water years.
8	Over-summering (June through September)	42	173	Settlement Agreement minimum releases for median above normal and wetter water years.
9	Rearing and outmigration (April through May)	29	202	TID and MID (1992) recommended minimum releases for an intermediate above normal/wet water year.
10	Spawning and incubation (October through December)	20	222	USFWS (1993) recommended minimum releases a critical water year.
11	Rearing and outmigration (April through May)	18	240	FERC (1996) staff recommended minimum releases for a normal/wet water year based on FERC's experience with a salmon production model.
12	Incubation and rearing (January through March)	34	274	FERC (1996) staff recommended minimum releases for a normal/wet water year based on FERC's experience with a salmon production model.
13	Over-summering (June through September)	27	301	FERC (1996) staff recommended minimum releases for a normal/wet water year based on FERC's experience with a salmon production model.
14	Rearing and outmigration (April through May)	38	339	TID and MID (1992) recommended minimum releases for a median wet/maximum water year.
15	Incubation and rearing (January through March)	11	350	AFRP Working Paper (USFWS 1995) minimum releases for a critical water year.
16	Rearing and outmigration (April through May)	56	406	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year.

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
17	Incubation and rearing (January through March)	26	432	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year.
18	Over-summering (June through September)	32	464	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year.

Table 6 shows draft guidelines for allocation of water acquired pursuant to Section 3406(b)(3) of the CVPIA for use on the Tuolumne River in intermediate dry-below normal water years. See the discussion of Table 2 for a more complete description of the columns and a definition of water-year types.

Table 6. Draft Guidelines for Allocation of Acquired Water for Use on the Tuolumne River in Intermediate Dry–Below Normal Water Years

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
1	Rearing and outmigration (April through May)	24	24	Settlement Agreement minimum releases for a median below normal water year.
2	Spawning and incubation (October through December)	26	50	Settlement Agreement minimum releases for median above normal and wetter water years.
3	Rearing and outmigration (April through May)	45	95	Settlement Agreement minimum releases for median above normal and wetter water years.
4	Incubation and rearing (January through March)	22	117	Settlement Agreement minimum releases for median above normal and wetter water years.
5	Over-summering (June through September)	42	159	Settlement Agreement minimum releases for median above normal and wetter water years.
6	Rearing and outmigration (April through May)	29	188	TID and MID (1992) recommended minimum releases for an intermediate above normal/wet water year.
7	Spawning and incubation (October through December)	20	208	USFWS (1993) recommended minimum releases a critical water year.
8	Rearing and outmigration (April through May)	18	226	FERC (1996) staff recommended minimum releases for a normal/wet water year based on FERC's experience with a salmon production model.
9	Incubation and rearing (January through March)	34	260	FERC (1996) staff recommended minimum releases for a normal/wet water year based on FERC's experience with a salmon production model.
10	Over-summering (June through September)	27	287	FERC (1996) staff recommended minimum releases for a normal/wet water year based on FERC's experience with a salmon production model.
11	Rearing and outmigration (April through May)	38	325	TID and MID (1992) recommended minimum releases for a median wet/maximum water year.
12	Incubation and rearing (January through March)	11	336	AFRP Working Paper (USFWS 1995) minimum releases for a critical water year.
13	Rearing and outmigration (April through May)	56	392	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year.

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
14	Incubation and rearing (January through March)	26	418	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year.
15	Over-summering (June through September)	32	450	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year.
16	Rearing and outmigration (April through May)	79	529	AFRP Working Paper (USFWS 1995) minimum releases for a below normal water year.
17	Incubation and rearing (January through March)	39	568	AFRP Working Paper (USFWS 1995) minimum releases for a below normal water year.
18	Over-summering (June through September)	90	658	AFRP Working Paper (USFWS 1995) minimum releases for a below normal water year.

Table 7 shows draft guidelines for allocation of water acquired pursuant to Section 3406(b)(3) of the CVPIA for use on the Tuolumne River in median below normal water years. See the discussion of Table 2 for a more complete description of the columns and a definition of water-year types.

Table 7. Draft Guidelines for Allocation of Acquired Water for Use on the Tuolumne River in Median Below Normal Water Years

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
1	Spawning and incubation (October through December)	26	26	Settlement Agreement minimum releases for median above normal and wetter water years.
2	Rearing and outmigration (April through May)	45	71	Settlement Agreement minimum releases for median above normal and wetter water years.
3	Incubation and rearing (January through March)	22	93	Settlement Agreement minimum releases for median above normal and wetter water years.
4	Over-summering (June through September)	42	135	Settlement Agreement minimum releases for median above normal and wetter water years.
5	Rearing and outmigration (April through May)	29	164	TID and MID (1992) recommended minimum releases for an intermediate above normal/wet water year.
6	Spawning and incubation (October through December)	20	184	USFWS (1993) recommended minimum releases a critical water year.
7	Rearing and outmigration (April through May)	18	202	FERC (1996) staff recommended minimum releases for a normal/wet water year based on FERC's experience with a salmon production model.
8	Incubation and rearing (January through March)	34	236	FERC (1996) staff recommended minimum releases for a normal/wet water year based on FERC's experience with a salmon production model.

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
9	Over-summering (June through September)	27	263	FERC (1996) staff recommended minimum releases for a normal/wet water year based on FERC's experience with a salmon production model.
10	Rearing and outmigration (April through May)	38	301	TID and MID (1992) recommended minimum releases for a median wet/maximum water year.
11	Incubation and rearing (January through March)	11	312	AFRP Working Paper (USFWS 1995) minimum releases for a critical water year.
12	Rearing and outmigration (April through May)	56	368	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year.
13	Incubation and rearing (January through March)	26	394	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year.
14	Over-summering (June through September)	32	426	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year.
15	Rearing and outmigration (April through May)	79	505	AFRP Working Paper (USFWS 1995) minimum releases for a below normal water year.
16	Incubation and rearing (January through March)	39	544	AFRP Working Paper (USFWS 1995) minimum releases for a below normal water year.
17	Over-summering (June through September)	90	634	AFRP Working Paper (USFWS 1995) minimum releases for a below normal water year.

Table 8 shows draft guidelines for allocation of water acquired pursuant to Section 3406(b)(3) of the CVPIA for use on the Tuolumne River in above normal water years (including intermediate below normal–above normal, median above normal, intermediate above normal-wet, and median wet/ maximum water years). See the discussion of Table 2 for a more complete description of the columns and a definition of water-year types.

Table 8. Daft Guidelines for Allocation of Acquired Water for Use on the Tuolumne River in Above Normal Water Years

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
1	Rearing and outmigration (April through May)	29	29	TID and MID (1992) recommended minimum releases for an intermediate above normal/wet water year.
2	Spawning and incubation (October through December)	20	49	USFWS (1993) recommended minimum releases a critical water year.
3	Rearing and outmigration (April through May)	18	67	FERC (1996) staff recommended minimum releases for a normal/wet water year based on FERC's experience with a salmon production model.

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
4	Incubation and rearing (January through March)	34	101	FERC (1996) staff recommended minimum releases for a normal/wet water year based on FERC's experience with a salmon production model.
5	Over-summering (June through September)	27	128	FERC (1996) staff recommended minimum releases for a normal/wet water year based on FERC's experience with a salmon production model.
6	Rearing and outmigration (April through May)	38	166	TID and MID (1992) recommended minimum releases for a median wet/maximum water year.
7	Incubation and rearing (January through March)	11	177	AFRP Working Paper (USFWS 1995) minimum releases for a critical water year.
8	Rearing and outmigration (April through May)	56	233	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year.
9	Incubation and rearing (January through March)	26	259	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year.
10	Over-summering (June through September)	32	291	AFRP Working Paper (USFWS 1995) minimum releases for a dry water year.
11	Rearing and outmigration (April through May)	79	370	AFRP Working Paper (USFWS 1995) minimum releases for a below normal water year.
12	Incubation and rearing (January through March)	39	409	AFRP Working Paper (USFWS 1995) minimum releases for a below normal water year.
13	Over-summering (June through September)	90	499	AFRP Working Paper (USFWS 1995) minimum releases for a below normal water year.
14	Spawning and incubation (October through December)	50	549	AFRP Working Paper (USFWS 1995) minimum releases for an above normal water year.
15	Rearing and outmigration (April through May)	58	607	AFRP Working Paper (USFWS 1995) minimum releases for an above normal water year.
16	Incubation and rearing (January through March)	106	713	AFRP Working Paper (USFWS 1995) minimum releases for an above normal water year.
17	Over-summering (June through September)	60	773	AFRP Working Paper (USFWS 1995) minimum releases for an above normal water year.
18	Spawning and incubation (October through December)	76	849	AFRP Working Paper (USFWS 1995) minimum releases for a wet water year.
19	Rearing and outmigration (April through May)	88	937	AFRP Working Paper (USFWS 1995) minimum releases for a wet water year.
20	Incubation and rearing (January through March)	93	1030	AFRP Working Paper (USFWS 1995) minimum releases for a wet water year.
21	Over-summering (June through September)	209	1239	AFRP Working Paper (USFWS 1995) minimum releases for a wet water year.

Chapter 34. Merced River

ERPP VOL. II

No flow-related actions listed.

ERPP STRATEGIC PLAN, APPENDIX D

No flow-related actions listed.

FINAL RESTORATION PLAN FOR THE ANADROMOUS FISH RESTORATION PROGRAM

The Merced River is an AFRP high priority river.

➔**Action 1 (High Priority).** Supplement flows provided pursuant to the Davis-Grunsky Contract Number D-GGR17 and FERC License Number 2179 with water acquired from willing sellers consistent with applicable guidelines or negotiate agreements as needed to improve conditions for all life-history stages of chinook salmon. Involved Parties: Merced Irrigation District (MID), Diverters, CDFG, DWR, USFWS, USBR. (AFRP, Page 85)

Action 2 (High Priority). Reduce adverse effects of rapid flow fluctuations. Involved Parties: MID, CDFG, USFWS, USBR. (AFRP, Page 85)

Evaluation 3 (High Priority). Evaluate fall pulse flows for attraction and passage benefits to chinook salmon and steelhead. Involved Parties: Dam operators, CDFG, USFWS, USBR. (AFRP, Page 86)

USFWS DRAFT GUIDELINES FOR ALLOCATION OF WATER ACQUIRED PURSUANT TO SECTION 3406(b)(3) OF THE CVPIA

Species and Life History–Stage Priorities

On the Merced River, the primary species of concern is fall-run chinook salmon. Steelhead may also be present in the Merced River in some years, but natural production of steelhead in the river is unlikely. Late fall run chinook salmon may be present, based on observations of adult carcasses in January and recently emerged fry in April.

Table 1 shows life-history stage prioritization for use in conjunction with the existing standards to generate guidelines for allocation of acquired water in the Merced River. The time periods in parentheses in the life history–stage column are approximate time periods when that life-history stage is present in the river. Actual time periods vary dependent on run-timing, environmental conditions, and rate of development.

Table 1. Draft Water Allocation Priorities for (b)(3) Water on the Merced River

Priority	Life-history stage	Objective
1	Spawning and incubation (October through December)	Improve attraction flows and provide adequate water temperatures for fall-run chinook salmon migrating into and spawning and incubating in the Merced River.
3	Incubation and rearing (January through March)	Improve spawning, incubating, and rearing flows and related habitat conditions for fall-run chinook salmon, and benefit sturgeon, striped bass, and other species through contribution to San Joaquin River flows and Delta outflows.
2	Rearing and outmigration (April through May)	Improve rearing and outmigration flows and related habitat conditions and provide adequate temperatures for fall-run chinook salmon in the Merced River; and contribute to improved conditions for survival of San Joaquin basin and Delta tributary fall-run chinook salmon migrating through the San Joaquin River and the Delta, and benefit other riverine and estuarine species, including other anadromous fish, through contribution to San Joaquin River flows and Delta outflows.
4	Over-summering (June through September)	Improve rearing habitat for over-summering juvenile chinook salmon and steelhead.

Recommendations

The CDFG and USFWS have provided flow recommendations for the Merced River. Preliminary flow recommendations were made by CDFG in "Restoring Central Valley Streams: A Plan for Action" (CDFG 1993). Recommendations made by the USFWS were developed by the AFRP in the AFRP Working Paper (USFWS 1995).

California Department of Fish and Game: The CDFG (1993) noted that existing standards in the Merced River are likely inadequate to accommodate migration, spawning, egg

incubation, juvenile rearing, and smolt emigration of fall-run chinook salmon, especially during the spring emigration and fall immigration periods. Although instream flow studies have not been completed but are presently underway (W. Loudermilk, CDFG Region 4, Fresno, personnel communication), CDFG (1993) provided interim flow recommendations based on instream flow study and smolt survival data from drainages similar to the Merced River.

Interim recommendations were made for five water-year types according to the San Joaquin River 60-20-20 Index; and recommendations for each year type include volumes of water for spring outmigration (April–May) and fall attraction (October). The recommendations during the spring are consistent with CDFG flow objectives for the San Joaquin River at Vernalis. To determine whether releases are depleted by riparian diversions, the CDFG (1993) also recommended that flows should be measured by DWR gages at Crocker–Hoffman Diversion Dam and Snelling, and downstream of Snelling. Even though implementing the recommendations would improve conditions beyond the existing standards, CDFG believed that the resulting conditions would not be optimal for chinook salmon spawning, rearing, or emigration, especially in dry years (CDFG 1993).

AFRP Working Paper: The AFRP developed flow recommendations that, in conjunction with other restoration actions, would result in at least doubling natural production of fall-run chinook salmon relative to the average attained during 1967–1991. The recommendations were based on the proportion of unimpaired flow that the Merced River contributes to the San Joaquin River, the historic hydrological regime, and results of an IFIM study conducted for drainages similar to the Merced River (USFWS 1995). Additional assumptions were that flows greater than historical flows in the lower reach of the river are needed to compensate for elimination of access to upstream habitat, and flows should not be reduced between spawning and outmigration to prevent redd dewatering and stranding of rearing juveniles. Recommendations were made for five water-year types according to the San Joaquin River 60-20-20 Index. Recommendations apply to the entire lower Merced River, Crocker–Hoffman Diversion Dam to the confluence of the San Joaquin River.

Draft Guidelines for Allocation of Acquired Water

The following tables contain draft guidelines for allocation of acquired water. Table 2 applies to a dry water year, as defined in the FERC license, using the minimum range of flows in the Davis–Grunsky contract. Table 3 applies to a normal water year using the maximum range of flows in the Davis–Grunsky contract.

Table 2 shows draft guidelines for allocation of water acquired under Section 3406(b)(3) of the CVPIA for use on the Merced River in dry water years pursuant to FERC License No. 2179 and the low range of flows contained in Davis–Grunsky Contract No. D-GGR17. The time periods in parentheses in the targeted life history–stage column are approximate time periods when the block of water identified in the block of water column would be allocated for the benefit of the targeted life-history stage. Actual time periods will be based on real-time observations of run-timing, rate of development, and behavior of chinook salmon in the Merced

River. The block of water will be managed to maximize benefits to anadromous fish, both in the Merced River and downstream, and in coordination with downstream water managers.

Table 2. Draft Guidelines for Allocation of Acquired Water for Use on the Merced River in Dry Water Years

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
1	Spawning and incubation (October through December)	6	6	FERC License No. 2179 minimum release for a normal water year and high range of Davis-Grunsky Contract No. D-GGR17.
2	Rearing and outmigration (April through May)	2	8	FERC License No. 2179 minimum release for a normal water year.
3	Incubation and rearing (January through March)	7	15	FERC License No. 2179 minimum release for a normal water year and high range of Davis-Grunsky Contract No. D-GGR17.
4	Over-summering (June through September)	2	17	FERC License No. 2179 minimum release for a normal water year.
5	Spawning and incubation (October through December)	29	46	CDFG (1993) recommended minimum release for a critical water year.
6	Rearing and outmigration (April through May)	30	76	CDFG (1993) recommended minimum release for a critical water year.
7	Over-summering (June through September)	42	118	CDFG (1993) recommended minimum release for a critical water year.
8	Spawning and incubation (October through December)	9	127	CDFG (1993) recommended minimum release for a below normal water year.
9	Rearing and outmigration (April through May)	23	150	CDFG (1993) recommended minimum release for a dry water year.
10	Incubation and rearing (January through March)	15	165	USFWS (1995) minimum releases for a critical water year.
11	Rearing and outmigration (April through May)	35	200	USFWS (1995) minimum releases for a critical water year.
12	Over-summering (June through September)	15	215	USFWS (1995) minimum releases for a critical water year.
13	Rearing and outmigration (April through May)	33	248	USFWS (1995) minimum releases for a dry water year.
14	Incubation and rearing (January through March)	9	257	USFWS (1995) minimum releases for a dry water year.
15	Over-summering (June through September)	12	269	USFWS (1995) minimum releases for a dry water year.

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
16	Spawning and incubation (October through December)	10	279	USFWS (1995) minimum releases for a wey water year.
17	Rearing and outmigration (April through May)	46	325	USFWS (1995) minimum releases for a below normal water year.
18	Incubation and rearing (January through March)	16	341	USFWS (1995) minimum releases for a below normal water year.
19	Over-summering (June through September)	10	351	CDFG (1993) recommended minimum release for a wet normal water year.
20	Rearing and outmigration (April through May)	46	397	USFWS (1995) minimum releases for an above normal water year.
21	Incubation and rearing (January through March)	76	473	USFWS (1995) minimum releases for an above normal water year.
22	Over-summering (June through September)	29	502	USFWS (1995) minimum releases for a below normal water year.
23	Rearing and outmigration (April through May)	66	568	USFWS (1995) minimum releases for a wet water year.
24	Incubation and rearing (January through March)	81	649	USFWS (1995) minimum releases for a wet water year.
25	Over-summering (June through September)	136	785	USFWS (1995) minimum releases for a wet water year.

Table 3. Draft Guidelines for Allocation of Acquired Water for Use on the Merced River in Normal Water Years

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
1	Spawning and incubation (October through December)	29	29	CDFG (1993) recommended minimum release for a critical water year.
2	Rearing and outmigration (April through May)	30	59	CDFG (1993) recommended minimum release for a critical water year.
3	Over-summering (June through September)	42	101	CDFG (1993) recommended minimum release for a critical water year.
4	Spawning and incubation (October through December)	9	110	CDFG (1993) recommended minimum release for a below normal water year.
5	Rearing and outmigration (April through May)	23	133	CDFG (1993) recommended minimum release for a dry water year.
6	Incubation and rearing (January through March)	15	148	USFWS (1995) minimum releases for a critical water year.

Priority	Targeted life-history stage	Block of water (TAF)	Cumulative total (TAF)	Source
7	Rearing and outmigration (April through May)	35	183	USFWS (1995) minimum releases for a critical water year.
8	Over-summering (June through September)	15	198	USFWS (1995) minimum releases for a critical water year.
9	Rearing and outmigration (April through May)	33	231	USFWS (1995) minimum releases for a dry water year.
10	Incubation and rearing (January through March)	9	240	USFWS (1995) minimum releases for a dry water year.
11	Over-summering (June through September)	12	252	USFWS (1995) minimum releases for a dry water year.
12	Spawning and incubation (October through December)	10	262	USFWS (1995) minimum releases for a wey water year.
13	Rearing and outmigration (April through May)	46	308	USFWS (1995) minimum releases for a below normal water year.
14	Incubation and rearing (January through March)	16	324	USFWS (1995) minimum releases for a below normal water year.
15	Over-summering (June through September)	10	334	CDFG (1993) recommended minimum release for a wet normal water year.
16	Rearing and outmigration (April through May)	46	380	USFWS (1995) minimum releases for an above normal water year.
17	Incubation and rearing (January through March)	76	456	USFWS (1995) minimum releases for an above normal water year.
18	Over-summering (June through September)	29	485	USFWS (1995) minimum releases for a below normal water year.
19	Rearing and outmigration (April through May)	66	551	USFWS (1995) minimum releases for a wet water year.
20	Incubation and rearing (January through March)	81	632	USFWS (1995) minimum releases for a wet water year.
21	Over-summering (June through September)	136	768	USFWS (1995) minimum releases for a wet water year.